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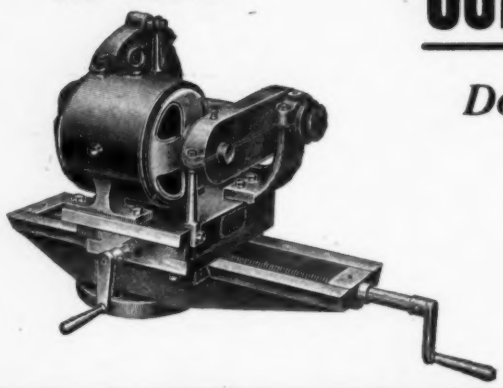

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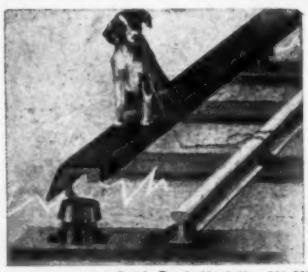

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Electricity Supply Development.

ON December 17th Mr. Stanley Baldwin mentioned Mr. Philip Snowden's speech in the House of Commons on electrical development, and said he was having the schemes that were submitted to the late Government very carefully examined, with a view to acting on them if it could be proved that such action would be beneficial to the country. As we pointed out in our issue of December 5th, a forecast of the Government's policy in respect of the development of electricity supply which appeared in the *Daily Mail* bore a marked resemblance to that outlined by Mr. Snowden, and differed but little from that of the Liberal Party.

The matter was dealt with at some length in the *Morning Post* of December 22nd, when the Government was credited with the intention of standardising frequency throughout the country on the basis of 50 cycles per second, at a cost of ten millions sterling, the work being spread over three years. The object of this scheme, it was alleged, was to facilitate the interconnection of the existing undertakings by "great arterial mains for the better distribution of more and cheaper power," and thus "to subordinate the service to the national interest rather than purely parochial needs." The phraseology is somewhat obscure, but the intention is good. It is mentioned that, as Mr. Snowden explained, the standardisation of frequency is in the national interest rather than that of the undertakings concerned, which could not be expected to incur a heavy and unremunerative outlay, but the Government, whilst facilitating the process with State funds, will not assume control; a representative of the *Morning Post* was informed from an authentic source that its policy would be "to lead and assist rather than fetter and control." That is a reassuring statement—for what it is worth; the State does not usually advance money without claiming a voice in its expenditure, but so far as the working

of the Trade Facilities Act affords an analogy, we may hope that it will be a trustworthy precedent for non-intervention in the conduct of affairs. The development of rural electricity supply was referred to by our contemporary, apparently on the strength of an interview with E.D.A., as being a direction in which extension was hoped for, and the conservation of fuel was also mentioned.

A later article, in the *Morning Post* of December 29th, contained further assurances that the Government's intentions were not tainted with Socialism, and that it would encourage private enterprise to continue the extension of electricity supply, on the ground that it was a public utility and that the more extended utilisation of electricity would lighten human labour and improve the conditions of life. We read, however, that—

> "It is, unquestionably, the duty of the Government to scrutinise this progress. More capital will be needed, and the investors must be safeguarded; adjacent systems must be grouped to secure greater economy and efficiency, and more evenly-distributed supplies, but the inevitable territorial monopoly must be defined within limits which will not permit of the exploitation of the consumer. There must be supervision of the interests of the security-holders, and of methods of operation, and, all the time, concentration on the main policy of development in the national instead of the local interest.
>
> "Responsibility in these matters can be accepted only by the State. Indeed, it is obvious at once that if there is to be monopoly—and there must be territorial monopoly to eliminate the duplication of capital and waste of machinery and labour—there must also be public regulation."

Municipalities will be required to assist the Government, and to abandon the petty parochial spirit which is attributed to them; they will have to "frame local regulations supplementing the general procedure dictated by the Government."

> "Far from savouring of Socialism, the Government's policy will be to regulate, stimulate, and co-operate with private enterprise, without discrimination, in the effort to assure more and cheaper electrical power for the nation as a unit."

All this is very interesting, if not convincing. It is somewhat difficult to understand just where control ceases to be control and becomes friendly co-operation and encouragement. A reference to the subject in *The Times* is even more baffling. It states that the Ministry of Transport will introduce a Bill in the coming session of Parliament which is "intended to tackle the whole question of the electrical supply of this country, and will probably propose the establishment of a chain of companies throughout the land, designed to provide electricity at a price which will allow neither profit nor loss." Curiouser and curiouser, as Alice would have said.

How companies are to be induced to undertake a business of this kind we fail to see; whatever the merits of companies, they have never, we believe, been accused of going into business in a pure spirit of altruism. Even municipalities have been known to look to their trading ventures for something in relief of the rates. Limitation of profits to a fixed rate, as in the case of the B.B.C., and regulation by a sliding scale, as in the case of certain gas companies, are propositions that can be understood; but to carry on business for the sole benefit of others—what is that but the purest Socialism, in the highest expression of that noble but fantastic theory? No!—The Baldwin Cabinet consists of practical men, whose heads are not in the clouds; and in the meantime, while it seems certain that important steps are impending, which are intended to promote the development of electricity supply, we must heavily discount these rumours and hope that the technical advisers of the Government will recommend a sane and sound policy, avoiding unprofitable outlay but spending freely where it is wise to do so.

The Future of British Trade.

THERE seems to be full justification for looking forward into 1925 as a year which will be marked by a strong and confident effort on the part of the British people to revive trade and industry. Not only will there be the effort, but we believe that substantial revival will actually take place, and that month by month the volume of unemployed labour will be reduced.

The change that has come over opinion in these islands as well as on the European Continent and in the United States indicates that the great majority-view, in places that matter most, and among people whose example tells with other parts of the world, is favourable to serious and quiet measures towards steady development, with revolutionary theories thrown overboard or to the winds at any rate for some time.

The recent utterances of eminent men who desire to guide us are deserving of our attention. There is no question about the entire suitability of the speeches of the president of the Board of Trade—Sir P. Cunliffe-Lister. It is obvious that the present Government recognises that it has it in its power to *assist* trade and industrial development. That is a lot better than the attitude of its predecessor which seemed inclined to let things take their own course. The knowledge that statesmen are willing to assist, imparts to traders and manufacturers just that spirit of willingness to make adventure, that has a way of eluding them if they feel that in high quarters there is an indifference as to their ultimate fate. Yet no Government, as he says, can restore prosperity unless the *whole people put their heart into the work.*

In one recently-reported speech, Sir P. Cunliffe-Lister said that manufacturers must be encouraged to invest more money in their businesses and to take more risks. This could only happen when there existed greater confidence and stability both here and in other countries with which they traded. The barriers that stood in the way of the full flow of trade must be broken down. If we could save money and invest it in the development of new markets, including the Empire; could produce our goods in larger quantities and therefore more cheaply; avoid misunderstandings between ourselves at home; and stand behind trade and foster it—we should be pursuing the course which was the only solution of unemployment. Our "only hope," he said, was the development of our foreign trade.

In another speech he said that trade prospects were definitely brighter, particularly in some districts, but there was a tremendous leeway to make up, and we still have to be told that what we must aim at is securing and retaining the greatest possible share of the existing markets of the world and the development of new markets. He repeated the very familiar but very necessary counsel that the needs of the markets must form the subject of most careful and thorough study.

Sir Auckland Geddes has been emphasising the necessity for maintaining our industrial and commercial security. We desire to continue "as a people" not as classes—therefore we must present a solid front to our great problem of trade development. He sees the desirability of there being a better understanding of our economic position as a nation; and for such understanding to be made more widely spread among the people. "Believe me, we are all in the foreign trade—whether we like it or not. There is absolutely no one single person in this country whose life, whose comfort, whose prosperity is not directly or indirectly, wholly or in part, determined by the state of our overseas commercial activities. We must always keep in mind our position as a nation, never forgetting our dependence on the trade overseas." If the nation applies itself heartily to the work of trade revival and refuses to fritter away its energies in disputes of one kind and another into which extremists are still only too anxious to lead us, the industrial position should be secured for this generation.

Commercial Electrical Travellers.

THE electrical industry is made up of many parts; interlocking they make up the complete organisation. We do well to recognise their interdependence, and wherever possible to appreciate the value of their individual contributions. Without unsaying anything that has appeared here regarding the value of technical qualifications in the sales engineer, we can give considerable praise to the commercial traveller and to the part he has to play in turning over many millions of pounds' worth of business every year for electrical manufacturers and traders. There are many kinds of commercial travellers in the electrical trade of course, just as there are good, bad and indifferent representatives in practically every calling, including engineering. If, as a result of a few experiences, one is tempted to regard them as belonging to a lower order, it is as well to call to mind also the fact that large technical businesses have been built up as the result of untiring effort on the part of those who started purely as commercial travellers. There are classes of electrical and engineering business which can be most effectively done, whether at home or abroad, by an engineer fully versed in the technics of the machinery and apparatus in which his employers specialise, provided that he knows how to negotiate a contract—how to sell. But there are commercial travellers who need not aspire to be fully-trained electrical engineers to enable them to carry on a continuous canvassing for orders for an individual class of electrical article, such as lamps, fittings, switches, fires, &c. Given a fair amount of common sense they are soon able to master the essentials of any one or two of these lines and to know the ropes of the trade. What should be avoided, however, is the error of imagining that anybody is good enough to put "on the road." It is said, and with some justification we fear, that the trade has itself to blame for much of this sort of thing. If the status of commercial electrical travelling could be raised it would be a good thing for everybody, and one way to secure that desirable end is to ensure security and fair treatment, and to avoid the constant changes from one firm to another, and "in" and "out" of the trade. The movement to organise an Electrical Trades Commercial Travellers' Association, of which we give particulars on a later page of this issue, though not expressly designed for such purposes, may well in course of time be able to count them amongst its achievements. There are identified with the scheme men who have spent the better part of a lifetime travelling in the sale of electrical goods, and they see the need for drawing the "fraternity" together and securing "united action on all questions affecting the welfare and advancement of the commercial traveller." Such matters as benevolence and mutual aid of a general character are foremost in the plan at present. We hope that the movement will have a good send-off at its inaugural gathering on Wednesday week.

Changing-over the Staff.

THE process of changing the system of distribution of electricity from d.c. to a.c., which has been in active operation in many undertakings since the war, is likely to continue for a long time to come; and it necessarily involves in some respects a radical change in the duties of the technical staffs concerned. Those members who have had the advantage of a comprehensive technical training, or have served in a.c. stations, have little or no difficulty in adapting themselves to the new order of things, but there are many whose whole experience has been gained in d.c. work, and the question arises: What is to be done with them? Apart from the exceptional cases where the opportunity may be taken to dispense with the services of a man who has failed to give satisfaction to his superiors, no chief would willingly deprive a trustworthy colleague of employment; but it is not only his right, but his imperative duty, to safeguard the *personnel* against accident and the system against breakdown due to incompetence on the part of any member of his technical staff. Hence he must take steps to satisfy himself that those who are to be entrusted with the installation and operation of plant and cables under the new conditions are fitted for the task, and no consideration whatever must be allowed to hinder the proper discharge of this duty.

We feel confident that the great majority of d.c. station engineers who read our pages realised long ago the necessity of preparing themselves to tackle a.c. plant, and that they have done their best to make good the deficiencies in their experience; those who have not done so have only themselves to blame, and can hardly expect to receive much sympathy. Moreover, ample warning is always given of the impending change, affording time for self-preparation.

The chief engineer being responsible for the conduct and safety of the undertaking will naturally prefer to test the competency of his staff himself, or, in the case of a large undertaking, he will delegate that duty to an assistant of unquestioned ability; the tests applied should be thoroughly practical and be directed solely to the determination of the fitness of the examinee to undertake his new duties. There is no reason why they should not be preceded by a short course of instruction on the job itself, for the object is not to test the general knowledge of the man, but his ability to do the work in hand. If this course is followed, he will be found either competent or incompetent—there can be no half-measures; the former event needs no comment, but in the latter case the only alternative to dismissal is to transfer the man to such other work as he is able to do efficiently.

Pulling Together in Illuminating Engineering.

WE have never concealed our opinion that the movement to impress on the public the benefits of good illumination needs the concerted action of all sections of the lighting industry, and of all bodies able to advance the cause of "better lighting." At the Conference on Illuminating Engineering held at Wembley on August 4th, 1924, a resolution was passed to this effect, endorsing the programme of the Illuminating Engineering Society, and the meeting of the Society held at the E.L.M.A. Lighting Service Bureau on December 16th, 1924, may be regarded as a clear indication of this spirit of co-operation. It is, we believe, a new and enterprising departure for the Society's meetings to be held elsewhere than on its customary platform—that of the Royal Society of Arts. It was fully justified; members of the Society, including a number of representatives of the gas industry, found much of genuine interest in the display of the latest lamps and lighting appliances. The demonstrations were intended to illustrate the Report on Progress in Lamps and Lighting Appliances presented at the last meeting of the Society, and the facilities of the Bureau in this respect are exceptionally complete. Things can be done on a scale that is naturally impracticable at the ordinary Society meeting; in addition, it is of evident benefit to the E.L.M.A. that the popular demonstrations should be shown to members of the Society who are experts on lighting and can discuss what is put before them in a friendly, but critical, spirit. The welcome extended by Mr. C. W. Sully, director of the E.L.M.A., to the representatives of the gas industry who were present, is a sign of the times. Gas and electricity are admittedly rivals, but there is much they can do in common to impress on the public the need for a generous estimate of the value of good lighting. We understand that a similar demonstration of advances in gas lighting will be arranged under the auspices of the Society in the near future, and we hope that many electrical engineers will attend.

E

Some Essentials of Good Loud-Speaker Reproduction.

By R. ROBERT.

ONE of the most frequent troubles associated with amateur-constructed multi-valve sets is, perhaps, the presence in the loud speaker of what is sometimes referred to as the "gramophonic effect." If there is no actual distortion, the reproduction may be harsh or metallic; it is difficult to distinguish speech; music sounds "blurred" or comes through with an objectionable "blare," and the quality of the reproduced sound generally leaves something to be desired. As a rule, such defects may be easily remedied by strict attention to a number of details in the design and construction of the receiving apparatus. Inefficient design or the use, or incorrect disposition, of inferior component parts is sure to bring its own Nemesis in the shape of inferior reproduction. In the short article to follow the writer hopes to give some indications as to how errors in the design and construction of receiving apparatus may be avoided, and really first-class loud-speaker results obtained by all valve set owners.

Circuit Arrangement.

The keynote, as it were, of all circuits designed to give the best results on telephony should be absolute simplicity. By this is meant that all unnecessary complications, or anything of an experimental nature, should be avoided. Dual circuits and "supers," for instance, interesting as some of the latter may be, are not to be recommended where the aim is faultless loud-speaker reproduction. For local broadcasting, up to a distance of about 20 miles, the writer would suggest three valves, consisting of a detector and two stages of low-frequency amplification. Beyond that range a radio-frequency amplifier might be added, bringing the number of valves up to four. Tuned anode coupling may be employed for the h.f. valve, and provision should be made for coupling the anode coil with the reaction. Particular care should be taken in the design of the h.f. part of the circuit, as it is, of course, essential that strong amplified signals be passed on to the detector valve. With reference to low-frequency coupling, there is the choice of (1) choke coupling; (2) transformer coupling; and (3) resistance capacity coupling. Of these three, for producing pure, distortionless signals, the last named is to be recommended, though it must always be borne in mind that with choke or resistance coupling the power available is never so great as with transformer coupling. Granted, however, a strong signal at the detector, two stages of efficiently designed resistance-capacity coupling should be more than sufficient to operate a large loud-speaker. It is not desired to disparage the usual transformer coupling, particularly as there are now quite a number of really excellent l.f. transformers available; but after some little experimenting with both methods of coupling the writer is convinced that for pure reproduction the resistance capacity is the better of the two. Should transformer coupling be adopted, the main points to observe are as follows:—Use only first-class transformers with ratios not higher than 3½ or 4 to 1 for first stage, and 1-1 ratio power transformers for all stages subsequent to this. Should exceptionally strong signals be required, or if there is a number of loud-speakers to be operated and more than *two* stages of amplification are found necessary, the secondary windings of the second and subsequent transformers should be shunted by a 2-megohm leak. It is perhaps unnecessary to state that care must be taken to ensure the "IPOP-ISOS" connections being made correct for the particular type of transformer in use.

Other points of importance in connection with the design of one's circuit are: (1) Individual tappings should be taken to the plate of each valve, so that each may receive its correct value of high pressure; (2) potentiometer control should be applied to the h.f. valve; (3) adequate provision should be made for biasing the grids of those on the low-frequency side; (4) the values of the condensers—particularly the small fixed condensers used for various purposes—must be carefully chosen, some suggested values being indicated in the short list below:—

Position.	Micro-farads.	Position.	Micro-farads.
Anode h.f. valve ...	.00025		
Primary 1st l.f. transformer ...	.001	Grid condenser ...	.00025
'Phone-blocking condenser	.002	By-pass h.p. battery	2.0
Resistance - capacity coupling condenser	.25	Loud-speaker	.01 to 1.0
		Aerial tuning ...	.0005 or .001

Choice of Component Parts.

Having planned out one's circuit diagram, it is now possible to go into the question of the components required. Some points to be observed are as under: (1) Ebonite should be of best quality, matted on both sides and guaranteed free from surface leakage; (2) tuning condensers should be carefully chosen. A good component is the new Sterling condenser, having specially shaped moving vanes to ensure a straight-line wavelength characteristic. Vernier adjustments are desirable, particularly for anode tuning; (3) valve holders should be of solid ebonite with legs widely spaced; (4) filament rheostats should be chosen for hard wear and tear, and undoubtedly the most satisfactory component is still the old circular rheostat with a moving arm making contact over a spiral of wire; (5) fixed condensers must be selected with particular care, and only well-known types, such as Dubilier, T.C.C., or Mansbridge employed, the cheap fixed condenser being a frequent source of trouble; (6) low-frequency transformers are perhaps responsible for 90 per cent. of the distortion met with in amateur-built apparatus. A number of good components which the writer is able to recommend from personal experience are the Eureka "Grand," Lissen "T," or Marconi "Ideal" for first stage, and the Sterling "Magnavox" where distortionless power amplification is required; (7) grid leaks, variable resistances, and fixed anode resistance are frequently a cause of inferior results being obtained, and should therefore be selected with care. For resistance-capacity coupling, the large Dubilier anode resistances may be used, and there appear to be several firms marketing a complete unit, comprising the necessary resistances and condenser for this type of amplification.

In the matter of assembling and wiring-up the receiving panel, some of the salient points are as under:—Components should be so arranged that all undesirable interaction effects are eliminated. This applies particularly where a number of stages of radio-frequency amplification are employed, as in this case interaction would result in unstable working and self-oscillation. The same thing applies, to a lesser degree, to the low-frequency side, and where several l.f. transformers are used, they should be spaced well apart or else be of the "shrouded" type, such as those already mentioned. Care must be taken to ensure that all soldered joints are efficiently made; imperfectly-made connections frequently result in noisy operation. Where anode reactance units such as the G.E.C. or Sterling are employed, it is sometimes difficult to determine which will be the right way round of the reaction. It is essential, however, that this should be definitely

determined before the unit is fixed in position and wired up. At this point it might perhaps be objected that, as absolute purity of reproduction is required, reaction might be altogether dispensed with. It will be found, however, that, carefully and intelligently used, reaction may actually *improve* the tone of a set, in addition to which it is an absolute essential where long-distance reception is required. The reactance units referred to will be found very efficient, but, if desired, the usual coil-holder arrangement may be used, and the reaction, if not required, short-circuited.

Valves and Loud-Speakers.

Given a straightforward three- or four-valve set, built up of only first-class components, the question of obtaining distortionless reproduction is then largely a matter of correct manipulation and of the accessories used. The most important of the latter are perhaps the valves, which should be chosen with every care, having due regard to the position in which they will be required to function. For high-frequency work, a valve having low inter-electrode capacity should be chosen; for low-frequency, one having a long straight portion in the grid-volts anode-current curve. This is an essential condition for distortionless reproduction and, further, where loud-speakers are to be operated, the emission must be large, necessitating the use of "power" valves.

For the convenience of the less experienced readers a short list is appended, tabulating a number of well-known values, together with their characteristics and the positions in which they will be found to function most satisfactorily.

With regard to the relative merits of dull emitter *versus* bright emitter valves, the candid advice of the writer is, if there are any facilities whatsoever for accumulator charging, to use the bright emitters. Dull emitters are not without their use where only headphones are concerned, but for really first-class loud-speaker results the bright emitter valve stands unrivalled. The one exception to this is perhaps the B4 type of valve, designed to give a heavy emission at 6 V .25 ampere, and valves of this type are to be thoroughly recommended as dull-emitter power valves.

It should perhaps be mentioned at this point that to obtain the best results, several makers recommend using valves to match the particular type of l.f. transformer in use. The utmost efficiency is claimed when the impedance of the valve is approximately equal to that of the transformer, and certainly there is something in this, as experiment with different valves will demonstrate.

Finally, there is the question of the most suitable loud-speaker, and for ordinary purposes this should be capable of handling a fair amount of power without "blare" or distortion. Speaking quite generally, the smaller types of loud-speaker may be ruled out, as they all suffer, more or less, from the "tinny" effect which it has been our object to eliminate. Of the large standard instruments, one might mention the Amplion AR19, Burndept "Ethovox," and Brown's H1. The first of these has a wooden flare and non-resonating sound conduit, and the results obtainable are certainly extremely good. The Brown speaker and the "Ethovox" are of the ordinary type with metal flares, and here, again, granted an efficient receiving set, the quality of reproduction can be very high indeed both for speech and music. The essentials of the standard loud-speaker seem to be: A sensitive electromagnetic system, a fairly large diaphragm, and well-designed flare which, again, should be of ample proportions. Resonance, if any is present, should preferably be on the lower notes of the scale and not the higher.

An extremely interesting speaker is the new Sterling product, which dispenses with both tone arm and flare, the sound being distributed by means of a pleated parchment diaphragm. On music the results are undoubtedly extremely good; the "trumpet" effect which is so noticeable a feature of the ordinary type of speaker is, of course, entirely eliminated, and the "tone" is excellent. On speech, however, results are not quite so good, and many people would no doubt prefer the ordinary horn type of speaker.

Use.	Type of Valve.	Fil'ment Volts.	Fil'ment Amps.	H. P.	Amplification Factor.	Approximate Impedance in Ohms.
High Frequency Amplification	V 24	5	·75	24—30	5	18,000
	DEV	3	·2	24—30	5·5	21,000
	Ora B	3·4—3·8	·6—·7	30—90	6·5	35,000—45,000
	Cossor P2	4	·72—·75	60—80	11	40,000
	Mullard H.F.	3·2—3·8	·6	30—50	9·8	40,000
	Myers	4	·6	20—300	—	—
Low Frequency Amplification	Mullard L.F.	3·2—3·8	·6	30—90	8·4	30,000
	Cossor P1	4	·72—·75	20—80	6·6	20,000
	Mullard RA	3·6—4·0	·07	50—100	—	—
Detector	Dutch Soft	4·0	·4	10—40	—	—
General	R Type	4·0	·75	50—100	7·5	25,000
	Ediswan A.R	4·0	·75	30—80	6·0	36,000
	R5V	5·0	·65	30—150	8	25,000
	Ora A	3·4—3·8	·6—·7	30—90	8·5	35,000—45,000
Dull Emitters (May be used in any position.)	B5, DE3, AR'06	2·4—3·0	·06	30—90	9·5	98,000
	D ER.	1·5—2·0	·4	30—70	8	40,000
	A.R.D.E.	1·8—2·0	·3	20—100	9	33,000
	Wecovalve	·8—1·1	·25	15—50	4·7	20,000
	Myers	2·5	·25	20—300	—	—
Power Amplification	Marconi LS2	6	1·5	200—400	5	8,000
	,, LS3	4	·65	100—200	4·5	10,000
	Mullard PA1	6	1·5	200—400	—	—
	,, PA2	5·2	·85	100—200	—	—
	,, PA3	4·0	·75	70—120	—	—
Power Amplification (Dull Emitters)	Marconi LS5	4·5	·8	100—500	5	6,000
	,, DE5	5	·25	30—150	7	7,000
	,, DE6	1·8—2·0	·4	90—110	5	12,000
	B.T.H. B4	6	·25	30—120	—	6,000
	Mullard DFA0	3·5	·35	50—100	—	—
	,, DFA1	5·5	·35	50—100	—	5,500
	,, DFA2	3·5	·25	50—100	—	—

Where possible, amplification factors and impedance values are given.

The Standardisation of Electric Motors for Machine Tools.

By C. W. HAXBY.

THE sale of machine tools of small, medium or large type, with self-contained motor drive, is increasing, yet a great number are still of the belt-driven class. In works of modern design it will be found that the majority of the machines are of the independent motor-driven type, eliminating unsightly lineshafts, countershafts, and belting, and giving the crane driver free access for work on the floor. As an instance of the increasing use of individual motor driving, the writer would state that one of the largest mills in Lancashire has recently discarded its steam engine, line-shafting, countershafting, and belting, each machine now having its own driving motor, and in some instances one motor driving two looms. The time is now ripe for a consideration on the part of all electric motor makers of the possibility of introducing universal standards of overall dimensions of motors for specified horse-powers and speeds for incorporation in machine tools. The varying sizes of motors for the same horse-power and revolutions-per-minute given by the makers are to all machine-tool builders and designers a very sore trouble.

The writer believes that the varying sizes of motors for specified h.p. and r.p.m. have limited the design of independent-motor-driven machine tools.

Many designers have given much time and thought to producing a really electrically-driven machine, with the motor and its equipment boxed or built in the machine. This outstanding factor of pleasing appearance, sound construction, &c., has not got very far, because another buyer comes along with another motor of different make, whose overall dimensions, centres, &c., are different from those of the motor for which the machine was first designed, involving a considerable alteration in the construction of the machine. Hence the tool does not become a standard design, or even a profitable commercial proposition. The present method of motor drive for a machine tool is more or less a makeshift; the motor is mounted on the top, or on the floor, and, unfortunately, the designer cannot hide the makeshift, for generally a machine is designed in the first instance for belt drive, and the motive power is a matter of adaptation.

Again, there are big differences between alternating- and direct-current motors. For machine-tool builders and designers the important requirements are that a motor of a given speed and h.p., &c., be standardised and made interchangeable with other makes of the same h.p., speed, &c., for direct or alternating current, when designed for the same kind of service.

The following are the important dimensions:—

1. The total length of motor.
2. The sizes of the motor feet.
3. Bolt diameters.
4. Height from base to centre of shaft.
5. The shaft diameter.
6. Length of shaft.
7. Keyway in shaft.
8. Diameter of the body.

An endeavour to make the bodies of both direct- and alternating-current motors the same in size may mean using a larger pattern for the direct-current motor than would be thought necessary from an electric motor designer's point of view, but the necessity of standardisation would outweigh this disadvantage.

As previously stated, a large number of machines are built for belt driving; these are not likely to be altered to independent motor drive unless there be a standardisation of all makes of motors and starting gear.

The starting gear is quite as bad for adaptation as the motor itself, owing to the variation in the sizes. It is quite as important to standardise these as the motor. Under the existing conditions the provision of accommodation for motors and starting gears in standard machines, keeping its appearance pleasing to the eye, without sacrificing stability and accessibility, is commercially impossible.

Putting Selling Power into the Electrical Interior.

By ERIC N. SIMONS.

THE retailer who is going to build up a prosperous business for himself must pay attention to even minor, or what at first glance seem to be minor, details of his shop organisation, because, however unlikely it may seem, they may have a quite important bearing upon sales. Whether it is the window, or the front of the shop, or the interior, it should be examined from the point of view of its power to attract or repel customers. Yet many electrical retailers whose methods of window-dressing and advertising are beyond reproach, fail to perceive the importance of the shop interior in selling.

It must not be forgotten, though it often is, that the customer will gather his impressions of the shop, the shopkeeper, and his methods of business, from the sight that meets his eyes as he pushes open the door and walks in. It cannot be denied that there are many electrical retailers whose shop interiors do not come up to the required standard. One of the most frequent faults they possess is a kind of deep gloom, caused to some extent by the heavy character of the stock, but caused far more by unsuitable window arrangement, insufficient light, and clumsy stock-keeping. To take bad window arrangement first, this generally means that things have been crowded so thickly into the window, and in so careless a fashion, that they shut out the light that would otherwise enter, and so make the interior dark on even the brightest days. This may be all very well at night, or for demonstrating electric lighting, but in effect it depresses and disheartens the customer, whether he is conscious of the fact or not. The ordinary man or woman likes a shop to look bright and cheerful, and a shop that presents an appearance of this sort tempts people more readily to purchase. If artificial light has to be relied upon during the day, it has a cheerless effect; makes the assistants appear pallid and weary; helps to dishearten them; makes them feel tired sooner than they otherwise would; and has a proportionately bad effect on the annual sales.

When, in addition to this bad window arrangement, the lighting of the shop itself is bad, the darkness is increased. One electrical retailer in the writer's district has all the upper windows, originally inserted to throw light towards the back of the shop, covered with black paper, in order to further some window scheme. The result can be imagined. Often, where a shop is naturally gloomy, the gloom could be reduced by letting in an extra window or skylight at small cost.

When clumsy stock-keeping is responsible for bad lighting, the trouble is entirely remediable. Stacked-up heaps of heavy goods, set too close to the source of light, throw deep shadows, keep out sunshine and light, and cause dark corners where otherwise all would be clear.

Another defect noticeable in many electrical shop interiors is congestion of floor space. There is one retail shop that forces its customers literally to tiptoe their way to the counter; stepping over articles here, there, everywhere, dreading at any moment to strike some tottering heap of boxes or parcels and fling them to the ground with a crash; tripping clumsily over miscellaneous articles left lying about; and at last, when the counter is reached, seeking vainly for some few square inches of clear space in which to rest gloves or parcels. It will be obvious to anyone that shopping carried on in such an interior can be neither pleasant nor comfortable. What makes this defect all the more irritating and conspicuous is its needlessness. There are only two thoughts possible to the customer who visits this shop, and neither is flattering. The first is: "This man is too mean to pay an assistant to help him put away his stock." The second: "This man is slovenly, and doesn't bother about the appearance of his shop. He will bother just as little about the things he does for me."

When the interior of a shop offers a pleasing and cheerful appearance, it is as effective as a good advertisement in making sales easier. A thing that has often struck the writer when in electrical shops is the lack of attention which is paid to the physical well-being of customers. If one goes into a draper's or a shoe store, one finds a plenitude of chairs and eager shop-

walkers anxious to secure one's comfort. But one is lucky if one finds even a solitary chair in an electrical shop. What is the reason for this? People often need to spend as long a time there as they do in a draper's, and especially when the shop is crowded. It almost seems as if the electrical retailer does not consider the physical comfort of his customers as important as other retailers do. But this is not really the explanation. It is merely that the electrical retailer has never consciously considered the matter, or that he hasn't room for chairs, or that he believes his customers to consist chiefly of the sort who come in for a bit of copper wire or a lamp or two, and stay a bare minute.

Again, many electrical retailers do not offer sufficient facilities to their customers for inspection of the goods they sell. Too often one finds the counter crowded with oddments or showcards, so that there is no room left for the customer to study the goods closely, nor for the assistant to demonstrate them. Often, again, the counter is insufficiently lighted, so that to look at the goods the customer has to go across to the nearest window or lamp. It seems to be considered an offence by the retailer if his customer chooses to lean over the counter on which he has carefully erected a precarious pile of pretty boxes or novelties. But, as a matter of fact, when a customer leans over a counter, it means that he is getting interested, and often the mere inability to get down to the business in hand prevents a sale from being carried to a successful conclusion. The wise dealer will, therefore, always leave room enough for his visitors to make full use of the counter.

One may now turn to a consideration of certain other matters of importance when considering the interior. First comes shelving. Some retailers will be able to afford oak shelving, which always presents a pleasing appearance, and enhances the dignity of the shop. But of course wherever this cannot be afforded, stained deal will provide a quite good substitute. It is not always easy to put stock away in a tidy yet effective way, because the shape and dimensions of the shop interior sometimes seem designed expressly to prevent this; but the defect can be made worse by the indiscriminate use of fixed shelves. This is not by any means essential. There are many advantages attached to moveable shelving. First, this enables stock to be readily moved—a great advantage. For example, there are occasions when it will be advisable to have a certain class of goods nearer the counter than others. This means that the stock will have to be slightly rearranged. If, then, the shelves, complete with their contents, can be easily removed without the tedious necessity of unburdening and reloading them, much time and trouble will have been saved.

It is not difficult to make moveable shelving oneself. One way is to insert iron strips, five-eighths of an inch in width, lengthwise in uprights measuring one-eighth of an inch. In these iron strips are then drilled circular holes at equal spaces of a quarter of an inch. Into these holes iron studs are fixed, which carry the shelving horizontally, with the shelves resting on them.

Another useful thing which the electrical retailer can do with his interior is to make it advertise the stock; or, rather, to make the stock advertise itself. On entering the ordinary electrical shop, one usually sees shelves full of boxes or packages containing unknown objects. There are no labels or names on these packages to state what their contents are. This is so much wasted advertising space. It can be utilised by attaching to each stack of goods little cards describing them briefly—where proper showcards are not possessed—and mentioning specifically one or two selling points. Thus:

> BROWN'S POCKET FLASHLAMPS.
> "WITCH" BRAND.
> Last for a month without recharging. All metal parts rustless. Better than matches. Price 1s. each.

It often falls to a customer's lot to be compelled to wait a few minutes in a shop, and while doing so, his eye cannot but rest from time to time upon the shelves and their contents, and consequently upon these little cards. There is always the possibility that he will thus have suggested to him some forgotten need or find within himself a previously unsuspected desire that he will gratify on impulse. Furthermore, it is always a good plan to open at least one box or parcel, and thereby enable the customer to catch a glimpse of the contents. If one visits a bookseller's, one will see all sorts of people browsing round his shelves until they find a book that interests them. Half a bookseller's sales are made in that way. The electrical retailer will do well to remember that fact and adapt it to his own business.

In short, the retailer must remember that his interior is an advertisement of value, and he should seek to make that advertisement as attractive and effective as possible. Only thus can he obtain maximum sales.

Notes on a Change-over from D.C. to A.C.

By A STATION ENGINEER.

THE following notes on an actual change-over may be of interest to engineers engaged on similar work.

In the station in question, the supply has hitherto been d.c. but as a bulk supply has been taken, it is desirable to change over to a.c., partly to save conversion expenses and partly to save feeder losses in an area of distribution which is rapidly growing larger. The supply of current for heating and cooking loads is a serious question for a d.c. network where the feeders are from one to two miles long, but it is much simplified with a.c. sub-stations placed at the centres of gravity of various areas.

Purely residential districts are supplied from single-phase transformers, on the three-wire system. The transformers are supplied from the outers of the three-phase high-pressure mains, and as one sub-station is balanced against another, there is no trouble with the out-of-balance current; indeed, the bulk supply plant is big enough not to notice anything of that kind. The s.p. transformers are of a handy size, and when the load in a sub-station increases, additional transformers will be added on different phases until eventually each sub-station will have three transformers served from three phases of the high-pressure mains. A three-phase supply is given in districts where there is much power load. The transformers for this are usually single-phase, being provided with windings which enable them to be run either s.p. or in a bank, connected mesh-star. The advantage of this method is that one transformer acts as stand-by either for the s.p. or for the three-phase sub-stations. Where transformers are of varying sizes and types, the question of spare plant becomes awkward in relatively small undertakings, although this difficulty wears off in large ones.

Where an old d.c. three-wire system is supplied from a three-phase sub-station, the supply is given through four-panel feeder pillars, and the distributors are balanced on the different phases. The neutral current is necessarily much higher than with single-phase supply, but it may be reduced by interconnecting the neutrals of the different phases at points as distant from the feeding points as possible. Such interconnecting should be carried out by disconnecting boxes to allow for separation for testing purposes.

In such districts it is desirable to supplement the old distributors with four-wire distributors to allow for the reduced efficiency of the neutrals. In many cases this will be found necessary in any event, as the old distributors will probably be loaded up before the change-over takes place.

The motor load provides a multiplicity of problems which will occupy the spare time of the department for many months. On single-phase systems one has to use single-phase motors, with centrifugal clutch pulleys where the motors cannot start up light. S.p. motors have a shocking power factor. When tested with an ammeter and wattmeter simultaneously, it will be found that while the wattmeter follows the load, the ammeter varies little from no load to full. This means that the current consumption is excessive at low loads. At the same time one has usually to put in motors on the high side for power, as they are not good for overloads. Sometimes a smaller motor is big enough, but users are apt to make trouble if they find that the new motor is smaller than the old one. It may pay in such cases to square the consumer by making an allowance to him for taking a motor of a smaller size, to save idle current on the mains. Commutator motors are sometimes necessary, but one must note that these, in certain designs, are not suitable for frequent starting, as they become hot unless there is a long period between the starts. Silence is important. Some good s.p. motors are very noisy, and this is often very objectionable. For instance, a noisy motor is no good for driving a pianola, for a dentist, or for a kinema. Church organs are a problem in themselves. In some cases fans are very good, provided that they can be placed outside the church itself. The best type will run pretty well in an adjoining room, if the motor stands on a thick mat, and if it is in a cupboard to keep down the noise. The air should be delivered into a box above the fan to deaden pulsation, and the pipe to the bellows must have a rubber or flexible joint. The fan generally takes half a minute to start up, and must therefore run for most of the service, but in some types the consumption running light is very small, and the bills for energy are not high. It is important to have the motor start with a plain switch. Some makers supply most elaborate starters, which are useless for organ purposes. The bellows should cut out the starter when the motor is up to speed by means of a cord and weight. In some cases a mercury rectifier has been used in series with a d.c. motor, which thus runs under its old conditions, but there is some hum both from the rectifier and also from the motor, as the pulsating current supplied by the rectifier causes the fields to make a noise. In one case the bellows of an organ are driven by a motor which starts up as a repulsion motor, and then automatically changes over to the induction type. This starts up very quickly, which is an advantage. The speed variation is carried out by sliding the belt on and off a loose pulley. The arrangement is quite satisfactory, as the motor is quiet in running.

The change-over of factory motors raises many difficult problems. Sometimes existing motors are too small, and users have to restrict their work to the capacity of the motor. These people expect that the new motor will be amply big enough, and one may often find it necessary to agree! There is this advantage—that the new motor will probably allow them to do more work, and pay for more energy. On the other hand, where the existing motor is twice as big as it need be—a common occurrence—Shylock himself could not be more anxious for his pound of flesh than the user is to get the new motor of the same size. There is room for diplomacy in such cases. Sometimes one may bargain to supply the consumer with an extra motor, he paying the difference between the cost of the one large motor and the two small ones, but this kind of bargaining requires an angelic temper on the part of the electrical man. There is a distinct tendency to fit three-phase squirrel-cage motors in preference to the slip-ring type, putting in centrifugal clutches where they have to start up on load. The squirrel-cage motor is so much more robust and simple that it is worth while sacrificing something in the way of easy starting to have it used largely. Ball and roller bearings are being used to a greater extent than before, although some large firms still stick to the plain type.

Transformers provide many interesting problems. Conservators are coming along, although these require very well-fitted covers to the tanks if leaks are to be eliminated. Tapping switches are also coming into common use. The great advantage of these is that the voltage can be varied according to the load on the transformers. With the old style of tapping control it is necessary to shut the current off for an hour or so to get at the tappings, and there is a danger of the workman dropping things into the oil. The current need only be off for a minute or so with tapping switches, and this enables one to vary the tappings whenever circumstances require it. It is necessary to go carefully into the problem of transformer impedance. Where the transformers are close to a big power station, large impedance is required to keep down rushes of current, but less may be used if the feeders between transformers and supply are some miles long. It is advantageous to stick, as far as possible, to one impedance, once one has got running, so that transformers may be interchanged without difficulty. The problem of polarities also requires attention. Manufacturers have varying customs as to polarity, and it will sometimes be found that one transformer gives quite a different polarity from another. This is awkward if transformers are interchanged, or if sections of distributors are changed from one transformer to another. The altering of the polarities of a three-phase transformer is not an agreeable job, especially if the work has to be carried out in a hurry, and it is better to get the trouble seen to before the transformer leaves the maker's works. It is also well to check over connections. Some of the best-known makers have sent out transformers with wrong connections, with lamentable results.

Where bulk supply is obtained through long feeders, an a.c. booster will be found most useful. Without it, pressure is low on peak loads, and away up on no load. This gives dull lighting and dissatisfaction on peak loads, and burns out the street lamps after eleven o'clock at night. With a booster one can correct the pressure with very beneficial results all round. The booster may be made to boost both up and down. This enables one to run the transformers on high tappings, so that they do not require excessive boosting on peak loads, while the reverse boost, after the evening load goes off, will keep the pressure down to a reasonable figure, thus preserving the street lamps and reducing lamp extinctions.

The book on "Switchgear and Electric Power Control," by Wedmore and Trencham, will be found useful for reference. Its cost is rather high, but its information is good and practical, two important points.

Another Wind-Power Machine.—It is stated in Berlin that a wind-power machine invented by Major Buelow, a German, which it is claimed can generate electricity at much less cost than any machine in existence, is to be tested very soon in Oxfordshire by the British Ministry of Agriculture and Fisheries. The machine consists of a long steel pole, on top of which is fixed what looks like a couple of aeroplane propellers, which revolve according to the force of the wind. They are storm-proof and have great resistance to the influence of the weather. Attached to them is a new kind of air-brake, which checks the speed of the wings in a gale by nearly one-third, with the result that the wings work during a gale just as regularly as if a mild wind were blowing. All the rotating parts run on ball bearings. The power is conducted directly from the propeller to an electric generator, which is of special construction tested for 3,000 revolutions per minute. A 10-kilowatt machine, or areo-dynamo, as it is called, with pole included, weighs roughly three tons. Such a machine, it is claimed, is large enough for use on an average-sized farm or in a small workshop, where at a small cost it could produce electric light and power and drive all sorts of agricultural machines, ploughs, saws, &c.—*Reuter* (Berlin).

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Kelvite" Heating and Ventilating System.

We have received from MESSRS. KELVIN, BOTTOMLEY AND BAIRD, LTD., 18, Cambridge Street, Glasgow, particulars of a "unit" heating and ventilating system which they have introduced. This device, which is eminently suitable for ships' cabins, although this does not exhaust its possibilities,

Fig. 2.—An Adaptation for a Lamp-type Radiator.

Fig. 1.—The "Kelvite" Heating and Ventilating Unit.

consists of a small motor-driven fan built into a housing in which is incorporated an electric heater. A special switch forms part of the unit and has four positions; by means of this the fan can be arranged to operate either without the heater, giving cool air, or with the heater full or half "on." The switch is so designed that the heater cannot be put into circuit unless the fan is running; thus overheating and waste of energy are rendered impossible. An adjustable delivery nozzle is fitted to enable the air stream to be directed in any way desired. The motor runs at a very low speed, and both it and the fan are noiseless. The advantages of this over the usual, general, method of heating and ventilating cabins will be easily appreciated. A view of the apparatus appears in fig. 1.

The "Electrodome."

A demonstration of the above-named device, which is an appliance invented by Mrs. LILLIE RAE for drying hair, was recently given under the auspices of the Institute of Patentees, 44, Great Russell Street, London, W.C.1. The device is in the form of a metal dome depended from an adjustable upright standard and is placed over the head; inside it an electric heating element is placed at the top and the dome is lagged so that it retains its heat. The aim of the inventor has been to provide an appliance that is simple to construct, cheap to manufacture and maintain, and can be manipulated by the user without assistance. The device, however, appears to have certain disadvantages.

A "Bone Dry" Accumulator.

The latest addition to the productions of the WILLARD STORAGE BATTERY CO., Cleveland, O., U.S.A., is a "Bone-Dry" battery for which many claims of efficiency and stability are made. The outstanding feature of the battery is its threaded rubber insulators, which, it is claimed, retain their insulating properties whether dry or saturated. The plates of the battery are charged in the factory and then dried; upon delivery the addition of an electrolyte at a service station makes it ready for use, giving it about 70 per cent. of its maximum capacity. The battery, which also will stand reasonable storage and shipping without internal deterioration, has been produced to enable motor service stations to handle it easily, as all that it is necessary to do to make it ready for use is to take out the seals and fill it with battery solution.

"Mosaic" Electric Fires.

A series of electric fires of a rather novel character has been produced by MESSRS. GIRLINGS, LTD., Electricity Works, Maldon, Essex. One of these so-called "Mosaic" fires is illustrated in fig. 3, from which it will be seen that the elements are mounted on small hexagonal bases, giving a decorative as well as a heating value to the fire. Each rosette has a separate spiral, and replacement is easily and cheaply carried out. The body of the fire is of cast aluminium and two switches are provided for heat control. The loading of the fire can be 1,500, 2,000, 2,500 or 3,000 W. An aluminium trivet and three spare elements are provided with each fire.

Fig. 3.—A "Mosaic" Fire.

The special form of the element permits it to be employed in the conversion of the lamp-type radiator as shown in fig. 2, three of the elements being mounted on a frame to which is fixed a lamp-cap plug.

"Pontelec" Rivet Heaters.

The heating of rivets by electrical means has proved an economical and convenient method of performing the work,

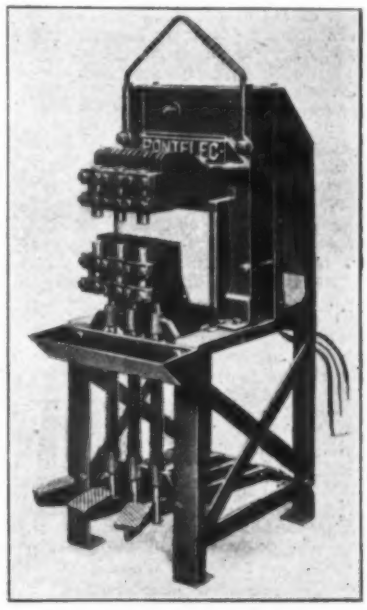


Fig. 4.—A Three-Head "Pontelec" Rivet Heater.

and it is quickly coming into general favour where large amounts of riveting have to be done. Among the most efficient

machines available for the purpose are the "Pontelec" rivet heaters, one of the latest patterns of which is illustrated in fig. 4. The standard design consists of a substantial angle-iron framework upon which are mounted a single-phase transformer with a regulating plug box, fixed and movable heads, and pedal gear. The transformer is built up of best quality "Stalloy" stampings, insulated from one another and rigidly clamped together. The secondary is a single loop consisting of a number of flexible copper strips in parallel, terminating in the top casting and bottom electrode clamp, a separate loop being provided for each head, there being three in the example illustrated. The fixed head is a massive copper casting having deep radiating fins which effectually prevent excessive heat being conducted to the body of the transformer, and the joint between this and the transformer secondary is well out of the high-temperature zone. The electrodes are easily replaceable, consisting of plain copper bar. The plug for regulating the rate of heating acts also as a switch, as when there is no rivet between the jaws merely a small magnetising current is drawn from the mains. The jaws are operated by the pedal gear and the grip is such that there is no danger of bending the rivet.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

A De Luxe Cabinet Model.

All enthusiasts have at some time or another wished to listen to concerts broadcast many hundreds of miles away. The aim of Messrs. Abgar Electrics has been, therefore, to place on the market receivers which, although simple to operate, are capable of loud reception over long ranges. Figs.

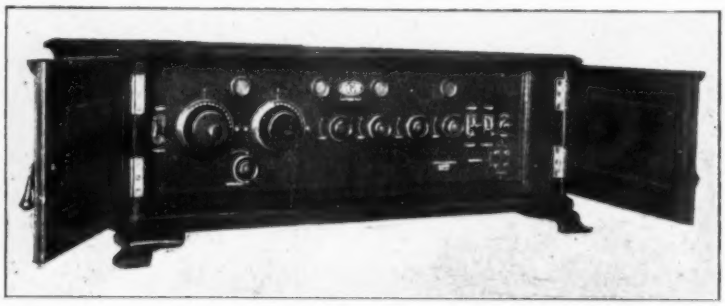


Fig. 1.—"Abgar" De Luxe 5-Valve Receiver.

1 and 2 are front and rear views of a 5-valve *de luxe* set, self-contained with the exception of the batteries; the latter could have been fitted inside the cabinet, but it is obviously undesirable to place them in close proximity to the working components of the instrument.

All the components (except the batteries) are completely enclosed, yet are readily accessible, and all connections are made at the rear of the cabinet, thus leaving the ebonite control panel clear of wire and terminals. Any type of valve, from the smallest dull emitter to the largest power-amplifying valve, may be used; they are situated inside the cabinet and provided with inspection and ventilation ports. The variable controls consist only of two graduated dials and one knob, and the connections are "foolproof," non-reversible plugs and sockets being utilised, and both plugs and sockets are clearly engraved.

Long-range reception is made possible by the use of two stages of radio-frequency amplification, and selectivity is assisted since tuned amplification is employed. All variable condensers are of the ebonite dielectric pattern, shielded by brass covers to eliminate hand capacity.

Volume is controlled by means of a simple switch, enabling the operator to dispense with any valves not required, and each instrument is sent out with sufficient coils to cover wave-lengths between 80 and 6,000 metres. The cabinet, in addition to its sliding top panel to provide access to the interior, is furnished with folding doors and, if required, a standard table on which the receiver may be placed, exactly matching it, is provided with enclosed space for all the necessary batteries, coils, telephones, &c.

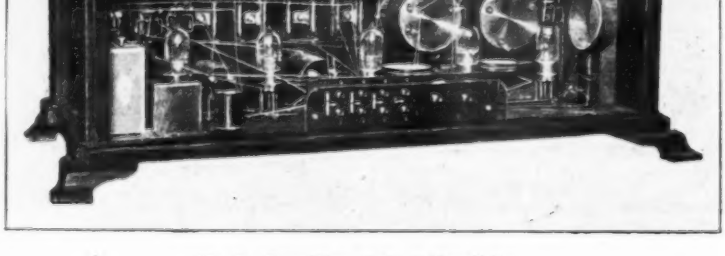


Fig. 2.—Rear View of the "Abgar" Set.

Light Headphones.

A pair of Sterling "Lightweight" radio head telephones has been sent us by the Sterling Telephone & Electric Co., Ltd. These headphones, which are made at the company's works at Dagenham, attain a high standard of workmanship and performance; lightness is apt to imply diminished efficiency, but reception with these is equal to that observed with the heavier types. The spring bow maintains a pressure which is conducive to good reception, but rather more intimate than we like—but heads are not all of the same shape, and some listeners prefer a close fit.

New Crystal Detectors.

There is not much in a crystal detector—at first sight; but when it is brought into use, it is soon realised that it may be a very troublesome device, very awkward to take down or

Fig. 3.—Gecophone "Unit" Detector.

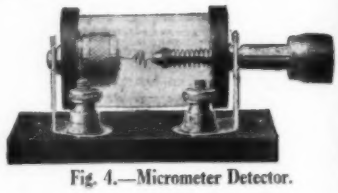


Fig. 4.—Micrometer Detector.

assemble, and unsuited for delicacy of setting. We were, therefore, pleased to receive from the General Electric Co., Ltd., samples of two detectors very well designed and of high-class workmanship, which we have found very convenient in use. The Gecophone "Unit" detector, fig. 3, is of the universal ball-joint type, with the ball-joint enclosed in a special spring cage, independent of the pressure between the end support of the detector and the ebonite housing. The detector arm is self-centring, and the cat's whisker remains where it is set. By lifting a small lever, the crystal end of the detector can be swung open without disturbing the rest of the device, and a new crystal can be inserted from the *outside* of the detector on the breech-loading principle, by means of a milled screw. The Gecophone micrometer detector, fig. 4, is provided with a fine screw feed, so that the most delicate adjustments can be made; free movement is also provided for searching the face of the crystal, and the ebonite knob handle is of substantial dimensions. The cat's whisker does not rotate whilst being fed forward. The crystal ("Gecosite") is held in a screw-on cup, so that it is easily replaced, and the metal parts are nickel-plated. We have found the crystal very efficient as a sensitive rectifier, and the adjustment all that could be desired. A detector of this type is very suitable for use as a rectifier in conjunction with valve amplification.

A Crystal Combination.

Messrs. G. Street & Co., Ltd., have introduced a crystal called "Uralium," which is used in conjunction with a silver cat's whisker. The combination is very effective, offering plenty of sensitive spots and rectifying efficiently.

A Simple Variable Condenser.

For simplicity it would be hard to beat the G.R.C. 60 "Express" variable condenser, introduced by the General Radio Company, which has only two plates, yet has a range, it is claimed, from 0.001 to 0.00001 mfd., so that it can cover a very wide band of wave-lengths with a single coil. One plate is fixed on a disk of ebonite, and covered with a very thin sheet of mica; the other, of springy copper foil, is fixed to the disk at one end and free at the other, and is pressed down by a second disk of ebonite with a polygonal knob handle. The edge of the second disk forms a dial divided

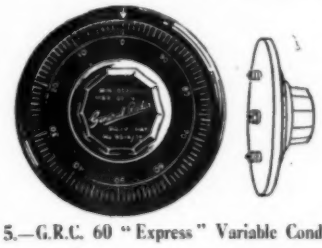


Fig. 5.—G.R.C. 60 "Express" Variable Condenser.

into 100 divisions. This disk is mounted on a screw, so that rotation of the disk varies the distance between the two plates and thus varies the capacity, which is 0.001 mfd. when the disk is hard down, and 0.00001 mfd. when the disk has made two complete revolutions. As shown in fig. 5, the condenser occupies very little space, and may be mounted close to another one without causing trouble from intercomponent capacity. There are, of course, no rubbing contacts, and the device can be used for any purpose in radio sets.

Legal.

A Smoke Nuisance Summons.

THE Burnley Paper Works Co. was summoned at Burnley Police Court on December 18th for an alleged black smoke nuisance. Mr. JOHN HACKING, manager of the company, said that in October the firm started a new paper-making plant, at a cost of £55,000. It applied to Burnley Electricity Department to supply the necessary power to drive the plant, offering to take 1,500,000 kWh a year, but, unfortunately, the Corporation asked a price double that of other undertakings, and the company was unable to accept the terms. The company had now made arrangements for supplying power for the new plant itself, and had put in new boilers, new engines, &c.

The case was adjourned.

A Workman's Compensation.

At the Leicester County Court on December 22nd his Honour Judge Dobb had before him a case under the Workmen's Compensation Act for arbitration and review. The applicants were the Brush Electrical Engineering Co., Ltd., and the respondent was Mr. Fred. Mitchell, a millwright. Mitchell was crushed between a crane and the wall at the company's works in March, 1923, and the case had previously been discussed at the Loughborough Court. At the Leicester Court several doctors, including specialists, were called by both sides. Doctors for respondent said that Mitchell was suffering from tuberculosis, but the doctors for the applicants disagreed.

Giving judgment, his Honour said that by arrangement the applicants had been paying respondent compensation at the full rate up to August, 1924. The employers had brought evidence to show that respondent was now fit for light work, and he was not satisfied that respondent was suffering from tuberculosis. He would give judgment for £1 a week compensation from June 25th to September 25th, and 12s. 6d. per week afterwards.

Correspondence.

Correspondents should forward their communications* at the earliest possible moment.** ***No letter can be published unless we have the writer's name and address in our possession.

Tidal Power and Windmills.

In your issue of December 12th, Mr. Massey, tracing the descent of hydro-compressors back to the ancient Forge Catalane, visits the sins of the ancestors upon the descendants. In the same way it would superficially be possible to disparage the modern steam engine by reference to the primitive apparatus of Hero of Alexandria. Methods which have originally proved inefficient may develop ultimately to a high state of efficiency. Even the despised windmill may yet come into its own, judging from recent reports of German trials of a new wind-power machine designed on aerodynamic principles and based on the results of modern research on aeroplane propellers.

The hydro-compressor, originally patented by Frizell in 1878, can produce air at any desired pressure, depending on the depth of the shaft and not on the available head of water. On the other hand, the Forge Catalane could only produce air at a pressure equal to the available head of water. Even these primitive compressors were shown by Romilly 50 years ago to be capable of an efficiency of 42 per cent. under proper conditions.

The efficiencies quoted in my article of November 14th, and to which exception is taken by Mr. Massey, are the results of tests published in the *Trans. Amer. Soc. Mech. Engineers* of May, 1900 (page 599) and the *Scientific American* of March 16th, 1907 (page 231).

A. J. V. Underwood, M.Sc., A.M.I.Chem.E.

London, *December 22nd*, 1924.

In endorsing the views expressed in your issue of November 7th by Mr. Wm. H. Massey, M.Inst.C.E., with respect to harnessing the Severn for the purpose of developing commercial hydro-electric power, it is the writer's opinion that, before an attempt is made to carry out any large tidal-power scheme under any system, the river water powers of the country already studied should be first developed, not only because they are very much cheaper to harness, much better, more reliable, and would represent greatly reduced maintenance costs, &c., but also because of the vast difference in overall efficiency in terms of the equivalent ratio of Q and H. For the equivalent of Q to be handled by the structures, buildings and foundations, hydraulic plant, &c., a very much greater volume and space is occupied by any tidal power scheme anticipated, all of which represents a relatively great deal more money.

William T. Taylor.

Rio de Janeiro, Brazil,
December 6th, 1924.

Trade Discounts and Direct Trading.

The letter in your issue of the 5th inst., under the above heading, has apparently been taken very seriously by Mr. Joseph, if we are to judge by his letter of the 8th inst. Has Mr. Joseph noticed, to quote the writer's own words, that "Before I *came* into the electrical trade, I was employed as cashier by a firm who never at any time, &c."? The letter might well have been written by a B.E.A.M.A. manufacturer with his tongue in his cheek.

One Who Served an Apprenticeship.

Leeds, *December 23rd*, 1924.

Electrical Trade Representatives.

May a slight explanation be permitted as to certain personal circumstances which led to the rather strong opinions expressed in this contribution being formed? Before the war I was outside representative for a firm of electric motor manufacturers, and since demobilisation I have been in the buying department of a large engineering concern. Therefore, after many years' practical experience of travelling, my position is now reversed; I am the interviewed and not the interviewer. Thus, I claim to know a little of the ground on both sides of the fence.

My section probably interviews during a week at least thirty representatives of various mechanical and electrical firms, and judging by an average spread over many weeks, those that impress one the least are those associated with the electrical industry. I do not wish to lay all, or even much, of the blame on the men. I am convinced that it is the firms themselves that must bear most of the burden.

First, as compared with the mechanical men, the electrical do not appear to know very much about what they have to sell. This may be due to the fact that a man representing steam gauges can specialise, whereas one representing an electrical firm of various manufactures cannot be expected to possess a knowledge ranging from scientifically designed shades to generators. But the fact remains, and to one in the electrical industry it is not satisfactory to know that when visits are made, say, for the purpose of following up quotations for a large plant, the electrical man leaves you the impression that he made a rush visit in the hope of getting an order, and that he appeared relieved that it was not necessary for him to supply any technical information.

Secondly, the frequency of new men from the same electrical firms is surprising. Representatives from mechanical firms have been with their firms for years; it is needless to ask them, they convey it in their talk, manner and appearance. With electrical representatives, however, the average in one job appears to be about half a year. A whole year is quite remarkable.

With regard to the reasons for all this, it seems to me that electrical firms appear to expect too much and pay too little. They do not trouble to get the right man. There is too much of the "Well, he can't cost much for a run, and if he makes good all the better." The traveller then endeavours to do

miracles in a few weeks and gets dispirited. The result is not beneficial to the firm or to the industry generally. Employers should never forget that to the customer the traveller is the firm, and those placed as I have been recently, can tell instinctively by the "atmosphere" of the traveller the type of firm he represents.

The reason for my complaint can be easily proved by comparing the advertisements for outside men in either industry. I have selected two recent examples, for obvious reasons slightly altering the manufactures:—

> "Wanted a Representative for a well-known steam plant manufacturer. Candidates must have had practical experience in this class of machinery and be of good address. State age, brief summary of career, and give any reasons as to why the candidate considers he would prove successful. Good prospects."

That is fair and square; there is an atmosphere of fifty-fifty about it. They do not expect the traveller, by waving some magic wand, to keep the works going. They have confidence in their manufactures and they want the right man to place them before possible customers.

The electrical advertisement reads:—

> "Wanted a Representative to sell electrical machinery to large buyers, Government Departments, Corporations, Railways. Applicants should have good connection. State age and enclose copies of testimonials. Salary moderate but good commission on results."

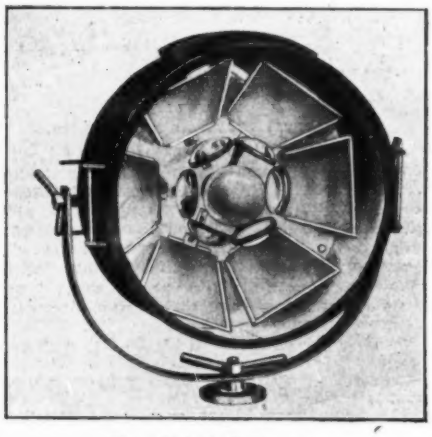
Who on earth do they expect to get? Very few men, if any, have a connection in electrical machinery. Cable, lamps and accessories that are always wanted, yes; but heavy machinery, no! The spade work may be done by the traveller, but the actual sale is dependent on the efficiency of the machinery, the standing of the firm, and the price quoted. If by any chance a man could get orders from such concerns by his personal connection, would he do so for a "moderate salary"?

A.

The Illumination of Large External Areas.

I should like to reply as briefly as possible to the letter *re* above, published in your issue of December 19th. Mr. Toplis says: "It would seem, however, that users, to whom such a matter should be of very great importance, are not readily availing themselves of such systems as are referred to by your correspondents."

If Mr. Toplis will look at my letter again (your page 880, December 5th issue) and paragraph marked (3) lines 7, 8, and



The "Blaizolite" Lantern.

9, and again in column 2 starting: "It is quite easy to illuminate horizontally, or semi-horizontally, dumps, ships' holds, railway and colliery sidings, large outside signs, large open spaces and squares, involved overhead tramway crossings, vast constructional works such as dams, &c., quays and jetties, iron furnaces, road and street constructional works," and concluding with the words, "and all the above are actually being illuminated by the lanterns referred to," I think he will agree that users *are* availing themselves of such systems.

Now as to the third paragraph of Mr. Toplis's letter and the question of shipyard illumination. Does not Mr. Toplis know that shipyards have been so slack that literally tens of thousands of employés have been thrown out of employment and that even the greatest firms have very little liquid cash that they can spare for improvements (or will so spare) even if they are *certain* of getting better illumination, for a reduced current consumption?

The equipment for such lighting of shipyard external areas is available, and will be utilised, when we reach better times! As to the Navy and searchlight projectors, there is a field on the seas for searchlights, which possibly no other gear will replace, but Mr. Toplis was talking of "The illumination of large external areas," and referring to high buildings and crane gantries that could be pressed into service, with projectors mounted at ground level, and with his metallic reflector fixed 200 feet away, at a height of 100 feet above ground level; this, I take it, refers to the illumination of all kinds of works and external areas on *terra firma*, and it was with such cases that I was dealing in my earlier letter.

Mr. Toplis anticipates my answer as to the disadvantages of arc projectors, the main disadvantage being that such projectors are of the hand-feed type, and therefore require the constant attention of a skilled operator, a disadvantage which would put Mr. Toplis's suggested equipment out of court for industrial purposes in most cases, if indeed it were not an insuperable difficulty. There are other points, such as large current consumption values, heavy cable runs, cost of carbons, and general upkeep (apart from a very heavy cost for the skilled operator necessary), the prime cost of the projectors and resistances, and the metallic reflector (with its mountings necessary for 100 feet elevation). What about wind pressure on a surface 10 feet in diameter, 100 feet high? Again, areas are not square, or equal. Most industrial areas requiring illumination are very uneven in character and form.

In the lantern I mentioned, focusing is not necessary after the lantern has been primarily adjusted for its particular work. This adjustment is obtained in a unique manner. The lantern is fitted internally with seven lenses, each in focus with separate points of the filament of a gasfilled lamp, and light beams are projected on to separate adjustable mirrors (25-45 vert. and lat.). A special diffusing front glass is fitted to the lantern, and thus no shadows appear on the plane of illumination.

With two only of these "Blaizolite" lanterns, fixed 450 *yards apart*, at a height of approximately 35 feet, opposing one another, each lantern fitted with one 500-watt lamp, this distance, with a width of approximately 35 feet, is easily and splendidly illuminated, and a small visiting card can be read clearly at any point of the area. Current 4 amps. at 250 volts.

In another instance, of a shale dump, an area of 10,000 *square yards* is being effectively illuminated by five such lanterns, consuming 2,500 watts, or just 2½ units per hour.

The lanterns were fixed not quite horizontally in both instances. The current consumption is exceedingly small, as will be seen, whilst the illumination is extremely effective, being totally out of proportion to the energy absorbed. I enclose an illustration of one of these lanterns (the photograph showing the front lens removed, more effectively to show the light source, *viz.*, the gasfilled lamp) which may be of interest. In conclusion, may I ask that Mr. Toplis will not blame me for challenging him as to the suggested insolubility of the lighting of external areas (which he now says he does not think he even suggested was an insoluble problem) as, in his original paper, he starts off with: "*Effectively illuminating external areas* on an economic basis *is a problem which illuminating engineers have yet to solve*" (page 764, November 21st issue).

I have tried to prove that his contention is incorrect, and have given him some examples of what has already been accomplished in this direction.

Harry E. Johnson.

December 29th, 1924.

Carbonising Coal with Electrical Heat.

Can you or any of your readers inform me if the carbonisation of coal by electrical heat has ever been tried? I have inquired from engineers in the gas industry, but no one has heard of it.

In view of the enormous heat loss and the heavy cost of labour and maintenance inseparable from existing methods, it would appear that there is a great field for electricity produced on a large scale by up-to-date plant.

If the electric steel furnace can show a good case, why not a coal furnace?

I should be glad to hear from furnace manufacturers with a view to an experiment.

Gas.

December 29th, 1924.

Sea-going Electricians.

With a view to obtaining information on this subject I would esteem it a favour if any reader of your valuable journal, who has sea-going experience as electrician, would kindly furnish the following particulars:—

Procedure *re* employment.
Shipping companies carrying electricians.
Wages and conditions.

Turbo.

Fife, *December 29th*, 1924.

Canadian Developments.—*Reuter's Trade Service* at Ottawa states that the amalgamation is announced of Canadian Vickers, Ltd., with Combustion Engineering, Ltd., representing the Canadian interests of the International Corporation of New York. The new company will carry on the work of the amalgamated companies in collaboration with consulting engineers in Canada, Britain, and the United States. The *personnel* of the company will be largely composed of Canadian engineers, and the chairman of the Board will be Sir Trevor Dawson.

Business Notes.

The "Electrical Review" Index.—The Index for the last half-yearly volume of the ELECTRICAL REVIEW (July to December, 1924) will shortly be published. Copies will be forwarded post free to those requiring them for binding or for reference purposes, if they will make application to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C.4.

Bankruptcy Proceedings.—P. BRADLEY (Bradley & Co.), electrical engineers, 16, Widemarsh Street, Hereford.—Receiving order made December 16th, on creditor's petition. First meeting, January 7th, at 2, Offa Street, Hereford. Public examination, January 26th, at the Shire Hall, Hereford.

A. MEADOWS, electrician, The Arcade, Penzance.—First meeting January 8th, at the Official Receiver's office, 12, Princes Street, Truro. Public examination January 19th, at the Town Hall, Truro.

A. WILSON, electrician, Market Place, Howden, Yorks.—Trustee, Mr. J. E. Stickney, Official Receiver, 36, Scale Lane, Hull, released December 8th.

D. C. FIELDING, wireless dealer, Cloth Market, Newcastle-on-Tyne.—Last day for proofs for dividend, January 24th. Trustee, Mr. J. C. Blakey, 28, Pilgrim Street, Newcastle-on-Tyne.

GEORGE ALBERT MORLEY, 201, Powis Street, Woolwich, electrician and wireless engineer.—The Official Receiver for the Greenwich District has declared a first and final dividend of 2s. 8d. in the £ to the creditors of the above.

L. N. STRIBLING and A. E. SETTERFIELD (Stribling & Setterfield), electrical engineers, 17, Market Place, Margate.—Last day for proofs for dividend, January 10th. Trustee, Mr. H. A. Ward, Official Receiver, 10, Burgate Street, Canterbury.

F. SMITH, wholesale electrical accessories factor, 6, Imperial Buildings, Dale End, Birmingham.—First and final dividend of 4s. in the £, payable January 12th, at 26, Corporation Street, Birmingham.

R. E. HUGHES and R. McL. ALEXANDER (R. E. Hughes and Hughes & Alexander), house furnishers and electrical and wireless engineers, 129, Brockley Rise, S.E., and 51, Honor Oak Park, S.E.—First and final dividend of 2s. 2d. in the £, payable January 5th, at the offices of Messrs. Corfield and Cripwell, Balfour House, Finsbury Pavement, E.C.

J. E. ELLIOTT (J. E. Elliott & Co.), electrical engineer, 12, Broad Street, Oxford, separate estate.—First and final dividend of 6d. in the £, payable at Carey Street, W.C.

W. A. BEAUMONT, electrical engineer, 44, Warrengate, Wakefield.—First and final dividend of 1s. 1½d. in the £, payable at the Official Receiver's office, 21, King Street, Wakefield.

Company Liquidations.—H. P. R. WIRELESS, LTD.—A meeting of members is called for January 26th at the offices of Messrs. Evans Smith, Boothroyd & Co., 79, Mark Lane, E.C., to hear an account of the winding up from the Liquidator, Mr. R. Evans Smith.

NORTHERN RADIO CO., LTD.—Winding up voluntarily. Joint liquidators, Messrs. W. A. Appleton and W. L. Sibley, 23, King Street, E.C. Meeting of creditors at the offices of Messrs. Ward & Melliar Smith, 35, Queen Victoria Street, E.C.4, January 7th.

BOOTLE ELECTRICAL CO., LTD. — A meeting of members is called for January 21st at 70, Central Buildings, North John Street, Liverpool, to hear an account of the winding up from the liquidator, Mr. C. Hodgson.

Dissolutions of Partnership.—EBONESTOS MANUFACTURING CO., manufacturers of electrical insulators, 127, Pomeroy Street, New Cross, S.E.—Mr. G. B. D. Weaver and Mr. J. B. Alexander have dissolved partnership. Mr. Weaver will attend to debts.

W. WALTERS & CO., electrical and mechanical engineers, 12, City Garden Row, City Road, E.C.—Messrs. W. S. and F. W. Golder have dissolved partnership. Debts will be attended to by Mr. W. S. Golder, who will continue the business.

LANGLEY & CROSS, electrical and radio engineers, 1, Westfield Road, Leeds.—Messrs. H. W. Langley and T. Cross have dissolved partnership. Mr. Cross will attend to debts and continue the business.

ATKINS & POWELL, electrical engineers, Windsor, Knighton, and elsewhere.—Mr. J. Atkins and Mr. A. S. Powell have dissolved partnership. Debts will be attended to by Mr. J. Atkins, of 59, Church Street, Tewkesbury, who will continue the business under the style of Atkins & Co.

Trade Announcements.—MESSRS. JOHN A. SMEETON, LTD., have removed to 15, Victoria Street, London, S.W.1.

THE HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD., of Hackbridge, has now moved its works and offices to Molesey Road, Hersham, Walton-on-Thames, where it has a much larger and fully equipped factory specially adapted for transformer manufacture. Telephone Nos.: "Esher 556-7." Telegraphic address: "Electric, Walton-on-Thames." Nearest railway station: Walton (Southern Railway).

Mr. DAVID S. MCCLURE, late of Claud Hamilton, Ltd., has opened a battery repairing and charging depôt in Buttermarket Close, 90, High Street, Ayr.

THE FLEXIBLE SHAFT MANUFACTURING CO., of Stratford, has appointed the Westminster Tool & Electric Co., Ltd., of Westcot Works, Putney Bridge Road, London, S.W.15, selling agents for its flexible shafts and accessories.

MR. HARRY B. BARNARD has been admitted as a partner in the firm of H. B. Barnard & Sons, of Glyn Street, Vauxhall, London, S.E.11.

The SCOTT INSULATED WIRE CO., LTD., has appointed agents as follows:—For the Midlands: Mr. J. E. Horsburgh, 8, Whittall Street, Birmingham. ('Phone No.: "Birmingham Central 3992.") For Scotland: Messrs. W. A. C. Smith, 92, Holm Street, Glasgow. ('Phone No.: "Glasgow Central 2520.")

The KEY ELECTRICAL SUPPLIES CO., of Leeds, ceased operations on December 31st, all liabilities being met in full. Mr. J. Ellison, one of the partners, will shortly commence business as an engineer and agent, at 18, Park Road, Leeds.

MESSRS. FULLER'S UNITED ELECTRIC WORKS, LTD., of Chadwell Heath, have removed their Swansea depôt from Pier Street, to more convenient premises at 51, Waterloo Street.

Catalogues and Lists.—THE MARCONIPHONE CO., LTD., Marconi House, Strand, W.C.2.—An illustrated price list of radio components of all kinds.

ST. HELENS CABLE & RUBBER CO., LTD., Slough.—A small pamphlet containing information regarding the company's ebonite.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—A well-illustrated catalogue of "Plexsim" heating and cooking apparatus. Priced.

BRITISH CENTRAL ELECTRIC CO., LTD., 6 & 8, Rosebery Avenue, E.C.1.—Three illustrated price lists dealing, respectively, with "Koh-i-noor" adhesive tape; Home Office switches, plugs, lampholders, &c.; and lamps of various patterns, and radio apparatus.

MERCHANTS & AGENCIES, LTD., 45, Basinghall Street, E.C.2.—Price lists of radio apparatus, &c.

THE ENTERPRISE MANUFACTURING CO., LTD., Grape Street, Shaftesbury Avenue, W.C.2.—A leaflet containing details and prices of radio components, including low-capacity valve-holders and loud speaker modulators.

MESSRS. JAMES MCMILLAN & CO., Clun House, 17, Surrey Street, Strand, W.C.2.—A pamphlet advertising Swedish iron and steel, including products for electrical construction.

Calendars and Diaries.—Our 1925 picture gallery promises to include all varieties of studies of the fair sex. "Cicely," the serious, who now joins them, adorns a calendar received from MESSRS. MAWDSLEYS, LTD., of Dursley.

No New Year would be as it should be, with us, unless we received one of the excellent wall calendars for which the D.P. BATTERY CO., LTD., of Bakewell, is so well known. That for 1925, in accordance with long-established custom, gives another view in excellent colouring of the district in which the works are situated; it depicts Sheepwash Bridge, Ashford-in-the-Water.

The largest calendar to hand this year is from MESSRS. C. & T. EARLE, LTD., of Wilmington, Hull (Earle's Cement). There is a large sheet per month with dates in big figuring.

MESSRS. SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., have sent us a neat little thermometer, suitable for the requirements of a motorist.

From the LONDON UNDERGROUND RAILWAY CO. we have received a handy "Engagements" pad, complete with pencil and calendar slips, and a useful map.

We have received from the MARCONIPHONE CO., LTD., a well-finished "Strikyu" matchbox, points that recommend it being that there are no sharp corners to tear the pocket, and it has a "permanent" striking surface for igniting safety matches. A pressure spring inside prevents inadvertent opening, yet there are no clips or catches.

MR. CECIL RIDLEY, of 35 & 37, Dundas Mews, Middlesbrough, has sent us a calendar for 1925 with an excellent colour-print thereon of "Flower of the Forest."

MESSRS. C. A. PARSONS & CO., LTD., of Heaton Works, Newcastle-on-Tyne, have issued a calendar with monthly sheets, each of which carries some half-tone views showing the various stages of manufacture of a 50,000-kW turbo-alternator.

MESSRS. COLLINS ELECTRICAL, LTD., of 115, Clerkenwell Road, London, have sent us a very practical accessory in the shape of a clothes brush, the back of which reminds us of their "redesigns, repairs, and rewinds."

From BROOKHIRST SWITCHGEAR, LTD., of Northgate Works, Chester, we have received one of their desk calendars for the first quarter of 1925. Each of the three monthly cards bears a delicate pencil drawing of features of interest in the City of Chester, a fourth card giving complete calendars for 1925 and 1926.

THE HOFFMANN MANUFACTURING CO., LTD., of Chelmsford, has issued a wall calendar with daily date slips at the centre of a ball-bearing design, which rests upon a bird's-eye view of the company's works.

The wall-sheet calendar with monthly date slips of the WESTINGHOUSE ELECTRIC INTERNATIONAL CO., 2, Norfolk Street,

London, W.C., has a charming picture showing the effective electrical illumination of the face of a maiden and of the ring that has been placed upon the significant finger of her left hand.

MESSRS. FRANCIS POLDEN & CO., LTD., of 56, Cannon Street, London, E.C.4, have issued a wall calendar with monthly slips and a daily indicator.

A calendar with monthly cards in a neat white and gold frame has been received from MESSRS. STEWARTS & LLOYDS, LTD., of Old Broad Street, London, E.C.2.

A desk calendar with monthly cards and a daily indicator has been received from the University Engineering College, Westgate-on-Sea.

The SUN ELECTRICAL CO., LTD., of 118-120, Charing Cross Road, London, W.C.2, has prepared a set of 1925 refills for its desk and memo calendar.

A date remembrancer for 1925, with monthly sheets, has been received from MESSRS. W. H. WILLCOX & CO., LTD., of 38, Southwark Street, London, S.E.1.

MESSRS. LINDSAY & WILLIAMS, LTD., Manchester, have issued a wall calendar with a block of large daily date slips placed within their "Megohmoid" trade mark.

From the PELICAN ELECTRIC, LTD., of Beehive Wharf, Brentford, we have received a pocket lighter.

SIMPLEX CONDUITS, LTD., has sent up a pocket calendar with a detachable card asking for selected publications relating to the company's products.

Book Notices.—"*Journal* of the American Institute of Electrical Engineers." Vol. XLIII. December, 1924. No. 12. New York: The Institute. Price $1.

"Kelvin Centenary Oration and Addresses Commemorative." Pp. vi+100; one portrait. London: Percy Lund Humphries and Co., Ltd. Price 6s. net.—This is a reprint of the Kelvin Oration delivered by Sir J. J. Thomson on July 10th, the speeches made at the Kelvin Banquet, and the memorial addresses of scientific societies presented at the centenary commemoration of the birth of Kelvin. An admirable reproduction in colours of the portrait of Lord Kelvin which hangs in the Council Room of the Institution of Electrical Engineers, makes an appropriate frontispiece, and the book is well printed and produced on good paper, forming a worthy souvenir of a memorable celebration.

Interim (Abridged) Report of Proceedings at the Empire Mining and Metallurgical Congress, June, 1924. London: The Congress.

"The *Journal* of the Junior Institution of Engineers." January, 1925. London: Percival Marshall & Co. Price 2s. One of the papers reproduced in this issue is "Fluid Transmission Gears," by H. G. Bouly. In addition there are notes of visits, "lecturettes," reviews, &c.

"Science Abstracts, A. & B." Vol. XXVII, Part 12. December 25th, 1924. London: E. & F. N. Spon, Ltd. Price 3s. each.

"The *Practical Engineer* Electrical Pocket Book and Diary, 1925." Pp. cxviii+674 and diary. London: Oxford University Press. Price 2s. 6d. net.—The principal alterations in this, the twenty-sixth, edition are the revision and re-writing of the sections dealing with single- and polyphase alternators, transformers and converters, primary batteries, and storage cells. The edition apparently went to press too early for the inclusion of the new I.E.E. Wiring Regulations, for those reproduced are the seventh edition.

E.D.A. Activities.—The latest publication issued from the offices of the British Electrical Development Association is a pamphlet quoting from the *Landmark* (the monthly magazine of the English-Speaking Union). It takes the form of an odious comparison between American homes with the bulk of the work done electrically and British homes which still labour under the disabilities of the Victorian era.

U.S. Loan for German Electricity Works.—An Exchange dispatch from Berlin, printed in the *Financial News*, states that the town of Bad Koesen is to receive an American loan of 700,000 marks for the building of electricity works. The loan will be issued at 85 and the rate of interest will be 7 per cent.

Electric Accumulator Regulations.—The Home Secretary has prepared draft rules under the Factory and Workshop Act of 1901 for the conduct of electric accumulator manufacture. The application of the regulations has been extended to cover works in which accumulators are repaired. The processes of lead burning and casting and incidental trimming work which give rise to fumes and dust of lead compounds are now carried on to a considerable extent in premises used solely for the repair of electric accumulators. So far as such processes are carried on in repair shops, the risk of poisoning is the same as in premises where accumulators are manufactured, and for this reason some occupiers of repair works have already voluntarily adopted the precautions required by the present regulations. The requirements for securing the application of exhaust ventilation and the maintenance of cleanly conditions have been strengthened so as to bring them up to the standard required in recent codes of regulations for other industries where danger of lead poisoning occurs. It is desirable that the regulations should be brought into force not later than January 1st, 1925, but as some of them may necessitate structural alterations which may take some time to complete, the Chief Inspector of Factories will be instructed to allow reasonable latitude before insisting on full compliance in such cases.

Russian Notes.—*Budget Provisions.*—The Council of Labour and Defence has confirmed a report of the State Planning Commission, which provides for the allotment of 35,620,000 roubles in the Budget for works at regional stations and the sum of 1,625,000 roubles for work at two other stations in 1924-25.

Electrolytic Copper.—The General Electrical Commission has received permission from the Supreme Council of National Economy to obtain from abroad 100,000 poods of electrolytic copper for the needs of the Central Electrical Trust and the Electrical Machine Trust. The national production of this quality of copper is inadequate for the requirements.

Foreign Specialists.—A committee of the Council of Labour and Defence has just approved and passed on for confirmation by a higher authority a list of the specialists required by the industrial trusts for the purpose of assisting in the development of Soviet industries. The list applies to engineers, &c., in the textile, electrical and chemical industries, who may be permitted to enter Russia for the object in question.

Replacement of Plant.—It is proposed to provide two new steam turbines for the stations of the Electroperedach, Moscow, or only one if the full amount of the credit necessary is not forthcoming. Small new turbo-generators are also intended to be erected at the Nisji-Tayail platinum mines so as to bring the total capacity up to 3,000 kW, while centralisation is deemed to be necessary for the electricity supply system at Novorossisk.

Shop-Window Lighting.—One of the most recent installations of shop-window lighting carried out by the illuminating engineering department of the Siemens & English Electric Lamp Co., Ltd., is that at Messrs. Lockwood & Bradley's

After-hours Shop-Window Lighting.

establishment, Charing Cross Road, W.C. The installation comprises a number of colour-matching units giving an even high-intensity illumination, and several spot lights to draw attention to special features of the display. These spot-lights can be effectively used for after-hours illumination, as shown in the accompanying illustration.

Price Reductions.—MESSRS. EVERSHED & VIGNOLES, LTD. announce substantial reductions in the prices of their standard models of the Ducter low resistance testing set equipments from the beginning of 1925.

"Constructive Stabilisation."—The current issue of *Petter's Monthly News* briefly sums up the present state of world affairs in the following confident words:—"The new Parliament assembles in a new atmosphere. It is an atmosphere charged with the electricity of fresh confidence, fresh courage, and fresh enterprise. All over the world the signs and symptoms of political and economic convalescence are unmistakable.

"'Let observation, with extensive view,
Survey mankind from China to Peru.'

"In every continent there is visible a definite swing towards settled order and constructive stabilisation. The period of chaotic despair and anarchical indifference appears to be nearing its end in all parts of the earth. The tendency to resort to violence and force seems to have spent its momentum. Everywhere the tide of revolution is ebbing. Mankind is in a conservative mood. It is more anxious to conserve than to destroy its resources."

Copper and Lead Prices.—Messrs. F. Smith & Co. report, December 31st:—Copper (electrolytic) bars £71 5s., 15s. increase; do. do. sheets, no change; do. do. wire rods £81 5s., 15s. increase; do. do. h.c. wire 10¼d., 1/16d. increase.

Messrs. James & Shakespeare report, December 31st:—Copper bars (best selected) sheet and rod £97, £1 increase; English pig lead £44 10s., 10s. increase.

British Trade Mark Applications.—The following are among the recent applications for British Trade Marks. Objections against any of the proposed marks may be entered within one month from December 17th :—

Uncle Tom's (lettering and design). No. 452,992. Class 8. Instruments and apparatus for use in wireless telephony and telegraphy.—Payne & Hornsby, Ltd., 6, St. Andrew's Buildings, Gallowgate, Newcastle-on-Tyne.

Listron. No. 453,413. Class 8. Detector crystals for use in wireless telephony and telegraphy.—W. G. Conway, 88 and 90, Chancery Lane, London, W.C.2.

Bemic. No. 453,432. Class 8. Apparatus for use in wireless telegraphy and telephony.—British Electrical Maintenance and Insurance Co., Ltd., Manningham Place, Poole Hill, Bournemouth.

Tomtit (lettering and design). No. 453,437. Class 8. Wireless receiving and transmitting apparatus and parts thereof.—C. A. Vandervell & Co., Ltd., Acton, London, W.3.

Kodisk. No. 453,611. All goods included in Class 8.—Kodak, Ltd., Kingsway, London, W.C.2.

Statuary Design. No. 453,835. Class 8. Thermionic valves.—Mullard Radio Valve Co., Ltd., 45, Nightingale Lane, London, S.W.12.

Tungstone. No. 451,589. Class 13. Accumulator boxes of lead.—W. Haddon, trading as John Haddon & Co., 132, Salisbury Square, London, E.C.4.

Dubilier. No. 453,182. Class 13. Electrical switches (ordinary). No. 453,183. Class 16. Electrical porcelain insulators. No. 453,184. Class 50. Electrical mica insulators.—Dubilier Condenser Co. (1921), Ltd., Goldhawk Road, London, W.12.

Blakasnite. Paines Restorer for Vulcanite (lettering and design). No. 451,310. Class 50. Polishing paste for vulcanite.—J. H. Paine, trading as Paine's Vulcanite Restorer, 28, Fordingley Road, Maida Vale, London, W.9.

Unemployment. — There was a large decrease in the number of persons registered as totally unemployed on December 15th, the total being 1,158,500—a decline of 23,688 in a week. The decrease since the beginning of 1924 amounted to 127,123.

Irish Free State Electrical Imports.—The imports of electrical machinery, apparatus and accessories into the Irish Free State during October last attained a value of £61,184—as compared with only £30,493 in the preceding month—bringing the total for the first ten months of the year to £403,426. The appended table shows the details of the imports and the amount attributed to Great Britain and Northern Ireland. The values show the quantity of goods consigned from the countries mentioned but it does not follow that they are all of British manufacture. Of the balance of £36,217 from foreign countries, £11,090 is attributed to Germany, £5,451 to Belgium, and £12,762 to Switzerland.

	Total Oct., 1924.	Ten Months, 1924. Total.	U.K. Share.
	£	£	£
Electric wires and cables ...	9,898	65,780	53,332
Telegraph and telephone instruments	1,265	25,283	25,158
Electric lamps and parts ...	5,090	19,677	18,506
Batteries and accumulators...	4,361	21,472	19,924
Electric lighting accessories and fittings	5,091	26,741	25,742
Radio sets and apparatus ...	5,768	84,383	82,283
Other electrical goods and apparatus	7,022	85,933	82,541
Electric generators	1,008	7,872	7,734
Electric motors	1,409	14,169	13,529
Other electrical machinery ...	20,272	52,116	38,460
Totals	£61,184	£403,426	£367,209

Wembley in 1925.—As the Prince of Wales will be absent from England during the Exhibition Season of 1925, the Duke of York will take his place as president of the British Empire Exhibition. It is officially announced that the Board will be Lord Stevenson, G.C.M.G. (chairman), the Duke of Devonshire, K.G., the Right Hon. J. H. Thomas, M.P., Lieut.-Colonel Sir A. Henry McMahon, Colonel the Hon. Sir James Allen, K.C.B. (representing the High Commissioners of the Dominions), and Sir Charles McLeod. Lieut.-General Sir Travers Clarke, K.C.B., K.C.M.G., will continue as chief administrator. Sir James Cooper, K.B.E., has accepted the position of financial controller of the Exhibition.

Fires.—A fire occurred at the premises of the British Battery Supply Service, Stepney, on December 28th, and a considerable quantity of accumulators was destroyed.

It is reported that five thousand radio sets were destroyed by a fire which occurred on December 27th at the works of Messrs. Stevens, Wolverhampton.

A great deal of electrical stock was destroyed at a fire on December 30th at the warehouse and workshop of Messrs. T. B. Watson & Sons, Ltd., plumbers and electrical engineers, Stockton-on-Tees. The building was completely gutted, with the exception of the shop in front of the premises. The company announced that it was able to carry on business as usual.

Local Exhibition.—LEICESTER.—Mr. T. P. Bentley is organising an All-Electric Exhibition to take place in October next. It is intended to make the show of a highly technical character, including the latest developments in the industrial, scientific, and domestic branches of electrical engineering.

Patent Restoration.—An Order has been made restoring Patent No. 161,573 of 1920, granted to Gesellschaft fur drahtlose Telegraphie m.b.H., for "Improvements in telephone systems."

New Indian Companies.—Among the new companies recently organised in India to undertake electricity supply are: The Agra Electric Supply Co., Calcutta (67, Clive Street) with a capital of 1,500,000 rupees; and the Rajahmundry Electric Supply Corporation (Madras) with a capital of 400,000 rupees.

Dutch Electrical Exports.—Dutch exports of electrical machinery and equipment during the three months, July to September, 1924, amounted to 3,122 metric tons, valued at 8,057,000 florins, as compared with 2,502 metric tons valued at 7,748,000 florins for the corresponding period of 1923, according to official statistics. The principal items of electrical apparatus exported were generators, motors, transformers, dynamos—chiefly to Belgium, Germany, and the Dutch East Indies—copper wire, insulated cable, and incandescent lamps. Exports of the last decreased slightly in both volume and value, even though shipments to Russia increased from 5 metric tons, valued at 15,000 florins in 1923, to 254 metric tons, valued at 1,467,000 florins in 1924. This gain, was, however, offset by the decrease in shipments to Argentina, which totalled 150 metric tons, valued at 1,378,000 florins in 1923, as against 31 metric tons, valued at 256,000 florins in 1924.—*Commerce Reports.*

Electrical Commercial Travellers.—The Electrical Trades Commercial Travellers' Association, to which we made a preliminary reference in the ELECTRICAL REVIEW for December 5th, 1924, page 854, is holding its inaugural meeting on Wednesday, January 14th, at 7.30 p.m. It will take place at the Lighting Service Bureau of the Electric Lamp Manufacturers' Association, by permission of that organisation. Mr. C. W. Sully, Director of E.L.M.A., will take the chair, and he will be supported by the following gentlemen :—

Messrs. Howard Williams, the Hon. C. Hope Morley, and W. P. Lees, representing the Royal Commercial Travellers' Schools.

Messrs. J. Paynter and Lawrence Smith, representing the Commercial Travellers' Benevolent Institution.

Messrs. J. Y. Fletcher and F. B. O. Hawes, representing the Electrical Trades Benevolent Institution.

Messrs. W. M. Goldsmith and A. S. Markes, representing the Southern Federation of Commercial Travellers' Associations (Federated).

Also by Messrs. A. E. Iliffe, L. G. Tate, J. W. Beauchamp, and E. F. Oldman.

The objects of the Association are stated as follows :—

1.—To assist the institutions (schools and benevolent) mentioned above.

2.—To draw the fraternity together, and enable members to combine in united action on all questions affecting the welfare and advancement of the commercial traveller. To render legal advice and assistance to members in matters arising whilst engaged in their employment.

3.—To provide a benevolent fund for the benefit of members, and to render assistance to them in time of need.

Membership will carry with it the advantage of a benevolent fund for members and for deceased members' widows; a special benefit fund, providing £10 at death; free legal advice and aid; and a permanent alpha whereby members may become life governors of the Benevolent Institution, Society or Schools. The proposed subscription is 10s. 6d. per annum.

We commend this movement to the sympathetic attention of travelling sales representatives of electrical firms, who are cordially invited to attend the meeting. The electrical trade, especially certain branches of it, depends upon the commercial traveller for a large part of its turnover. It will be for the good of the industry, as well as for the peace of mind of the travellers themselves, if they can be brought together for the excellent purposes indicated above. Given success in these directions there is no reason why their activities should not, at a later stage, embrace other matters which might be dealt with unitedly to the advantage of the trade.

Those who wish for information beyond that already given are advised to communicate with Mr. R. F. Norris, hon. secretary (*pro tem.*), 235, Sheen Lane, East Sheen, S.W.14, or with Mr. A. S. Markes, the hon. secretary of the Southern Federation of Commercial Travellers' Associations, Ashfield, Crescent Road, Crouch End, N.8.

For Sale.—Mr. H. J. Shaw will offer by auction on January 5th, at 85, Newington Causeway, S.E., a quantity of wireless and electrical goods, including cable, flex, conduit tubing and fittings, &c. Liverpool Corporation electricity supply department invites offers for five 200-kW motor-generators now lying at the Pumpfields Station, Vauxhall Road, Liverpool. By order of the Lords Commissioners of the Admiralty, Messrs. Fuller, Horsey & Co. will sell by auction on February 3rd at the Admiralty Depôt, White Lund, near Lancaster, surplus plant and machinery, including electric motors, alternators, generators, &c., and a new 2,000-h.p. Sulzer Diesel engine. (See our advertisement pages to-day.)

French Import Duty on Electrolytic Copper.—The Union des Syndicats de l'Electricité has consulted the associated syndicates on the question of the proposed imposition of an import duty on electrolytic copper. The syndicates have unanimously protested against the scheme, and a communication in this sense is being sent to the Minister of Commerce.

Electricity Charges in the City.—As a result of the inquiry into the charges for electricity in the City of London, held recently by the Electricity Commissioners at the instance of the London Chamber of Commerce, the Charing Cross Electricity Supply Co., Ltd., reduced its charges from 8d. and 2½d. per kWh to 6d. and 2d. per kWh, as from the beginning of September. The Chamber of Commerce informs us that the effect upon consumers individually, those, namely, on the general tariff basis—and of these in 1923 there were 5,265—would be as follows:—2,415 would benefit to the full extent of the 2d. per kWh, whilst approximately 2,500 would obtain varying proportions of that figure. The remainder, some 360, would have to pay more. The London Chamber of Commerce Committee is profoundly dissatisfied with this result. The attitude which it has adopted was based on the fact that, having obtained power to increase its charge to 8d. in 1920, the company paid a dividend of 7 per cent. for 1919, 8 per cent. for 1920, 9 per cent. for 1921, 14 per cent. for 1922, and 14½ per cent. for 1923; and, in addition to this, in 1923, by capitalising reserves, a bonus of £96,000 was distributed amongst the members of the company in the form of fully-paid shares.

The Committee is to meet again early in the New Year. In addition, a large number of consumers on the system of the other company operating in the City, the City of London Electric Lighting Co., Ltd., will also benefit as an indirect result of the inquiry. That company has announced a similar reduction.

The Times reports that the principal subject of discussion at the "Wardmotes" held in the City of London last week, to elect representatives to the City Corporation, was the high cost of electricity, and strong protests were made at the fact that the charges were so much higher than in other districts of London. It was pointed out that on the City side of Eldon Street the ratepayers were paying twice as much for electricity as those on the other side of the road, which was in the Borough of Shoreditch.

Removal of German Import Restrictions.—The Commercial Secretary at Berlin (Mr. J. W. F. Thelwall) has informed the Department of Overseas Trade that according to the local Press, a Decree issued by the Reich Ministry of Economics as a further step towards the decontrol of foreign trade, will shortly be published in the *Reichsanzeiger* containing another list of goods, the import of which is to be permitted without licence. Articles coming under the following categories are included:—Electro-technical products and vehicles (not motor vehicles).

Bradford Radio Traders' Association.—At the December general meeting of the Radio Dealers' Section of the Bradford Chamber of Trade considerable correspondence was submitted which had passed between the section and various manufacturers and others, relating to the efforts being made to stop price cutting. The whole of the replies received were reported to be satisfactory. Further complaints were received respecting price-cutting by local traders. It was alleged that one firm in particular was cutting proprietary articles materially, and the meeting decided on certain steps to deal with the matter. The question of the wide difference in prices of small goods was discussed, but the meeting decided that for the time being the Society should centre its chief activities in stabilising the prices of proprietary lines, with special emphasis on means of tracing sellers of these as between manufacturer and retailer. Notice of motion was given for the January meeting raising the question of the unfairness of wholesale firms selling goods by retail across the counter to people not in the radio business, to the detriment of the legitimate retailer.

Cable Makers' Wages.—The employers in the cable-making industry have declined to grant an increase of 10s. per week to their employés, and the executives of the trade unions concerned have been asked to allow a ballot to be taken to decide upon the course to be followed. Mr. L. B. Atkinson, chairman of the Joint Industrial Council, is reported by the *Daily Herald* to have said that it was not true that the employés had conceded 18s. per week in recent years, apart from sliding scales. There had been a "cut" of 6s., but this had since been restored. He agreed that the industry was prosperous, but he refused to believe that wages should be settled from day to day by the prosperity of the industry. Was the industry to pay labourers more than skilled engineers?

Social Events.—The staff of the Mullard Radio Valve Co., Ltd., is holding a dance at the Horticultural Hall, S.W., on January 9th.

On December 19th the technical staff of the Stepney electricity supply undertaking held its fifth annual dinner, the date also marking the completion of the 25th year of the undertaking. About 90 members and friends were present, and during the evening Mr. W. C. P. Tapper, the borough electrical engineer, was presented with a set of silver table centre-pieces. The toast of "The Visitors" was proposed by Mr. W. F. Andrews and replied to by Capt. P. Dunsheath, Mr. J. A. Lee, and, on behalf of the ladies, Mrs. Tapper.

Engineering Workers' Wages.—The answer of the engineering trade unions to the statement of the Engineering Employers' Federation showing that it was not possible to grant the 20s. per week increase for which the unions applied was to be presented at a joint meeting in London yesterday.

New Australian Company.—The Pacific Electric Co. was recently registered in New South Wales. The company has a capital of £10,000, and intends to engage in the construction and repair of electrical articles.

New Works Club.—The employés of the Stafford works of the English Electric Co. have (thanks to the firm's generosity) been provided with well-equipped club rooms. The extensions, which cost £3,000, are situated at Stychfields, and provision is made for all popular forms of indoor recreation. The premises were recently opened by Mr. John Sampson, C.B.E., who was accompanied by Mr. W. L. Hichens (deputy chairman), Mr. P. J. Pybus, C.B.E. (managing director), Sir Arnold Gridley (general works manager), and Mr. A. H. Sturdee (Stafford works manager). The new club includes facilities for games, a reading and writing room, baths, and dressing rooms.

Havana International Samples Fair.—His Majesty's Chargé d'Affaires at Havana, Cuba (Mr. T. F. Morris), in a recent dispatch to the Department of Overseas Trade, draws attention to the desirability of strong British participation in the International Sample Fair of Havana, which is to be held in May next. He points out that the last fair enjoyed a definite success, particularly as an advertising medium, and that foreign manufacturers exhibited in considerable strength. American, Spanish, German and French firms in particular were well represented, either directly or through local agents. Exhibits were also made by firms from Switzerland, Italy, Czecho-Slovakia and Mexico. The purchasing capacity of Cuba has increased in comparison with pre-war years. In 1922-23 goods to the value of over 226 million dollars were imported. Mr. Morris suggests that United Kingdom firms already interested in the market would do well to discuss the question of participation with their local agents, and that firms desiring to enter the Cuban market would find the Fair an excellent starting point.

Electricity Supply Workers' Wages.—The National Joint Industrial Council for the Electricity Supply Industry states that in accordance with the 1921 Terms of Settlement the next wages revision will take place as from January 1st, 1925, based upon the average of the cost-of-living index figures in the three preceding months. The average of these figures is 79 per cent, which, if deducted from the datum figure of 120, leaves 41 points, or 6 cycles of 6 complete points. As there have been seven variations (net) to date, there will therefore be an increase of ½d. per hour as from January 1st. Attention is called to the fact that the present increase of ½d. per hour would have been 1d. per hour had it not been that the reduction of ½d. due on July 1st, 1924, was restored by agreement, thus giving to the employés ½d. per hour in excess of what they were entitled to under the terms of the sliding scale agreement.

At a meeting, held on December 22nd, the No. 2 District Council for the Electricity Supply Industry (Yorkshire, &c.) adopted the report of a special committee recommending that the suspended ½d. per hour under the sliding scale should be made permanent; that a further ½d. per hour should be granted to all grades; and that the sliding scale should operate in future in the ordinary manner. The increase of ½d. per hour was to take effect as from the first pay day in January, 1925, provided that no application for further increase is made during 1925.

In the West Midlands Area there was also to be an increase from January 1st in the pay of youths and apprentices employed by constituent undertakings, as follows:—9d. per week in the case of boys of 16 and 17 years of age, and 1s. 4d. per week in the case of youths of from 18 to 20 years of age inclusive.

The District Council for the North-Western Area has failed to agree upon the question of the restoration of the 10 per cent. cut in wages made in 1923, and the matter is to be referred to the National Council.

Electrical Manufacturing in Paris.—According to a French correspondent, the major part of the electrical manufacturing industry of France is located within the immediate vicinity of Paris, there being no fewer than 70 works within a radius of 37 miles of the capital which are engaged on the production of generators, motors, transformers, and electrical apparatus. These works, which do not include contracting concerns, employ 22,000 workmen, and the capital invested in them is 400,000,000 fr.

Chinese Notes.—The Sintsih Electric Light Co. at Shulu (Chihli Province) has been granted registration by the Ministry of Communications on condition that the plant shall be in operation within six months of the date of registration. The company has a capital of $12,000.

Arrangements have been made with the Chih Ming Electric Light Co. for the lighting of the roads which have recently been completed at Chengtu (Szechwan Province).

A radio station has recently been placed in commission at Yunnanfu.

Six single-deck Tilling-Stevens petrol-electric omnibuses have recently been put into service in Shanghai by the China General Omnibus Co., and 24 others are under construction.

The Honan Government is planning the installation of a long-distance telephone system in the northern part of the province, similar facilities having been provided for in the western, eastern and southern parts.

The Ministry of Communications has registered the Tsanghsien Telephone Co. (Chihli Province), with a capital of $6,500.

An Important Sudan Contract.—The Special Correspondent of the *Daily Mail* at Khartum reports that a contract is to be signed this week between the Sudan Government and a British industrial group for the construction of a nine-span steel bridge across the White Nile from Khartum to Omdurman. This group, which has a capital of £350,000, to be supplemented by a loan of £400,000 under the Trade Facilities Act, consists of the Prudential Assurance Co., the English Electric Co., Ltd., Dorman, Long & Co., Ltd., and Callender's Cable & Construction Co., Ltd. The group is also to take over the present steam tramway system and electrify it, supply electricity in Khartum and Omdurman, and to lay water mains. These undertakings will all revert to the Sudan Government in 1955 upon repayment of the loan and capital. The *Morning Post* of December 30th claimed that the report that the contract was actually to be signed was premature.

Lighting and Power Notes.

Canada.—ST. LAWRENCE RIVER DEVELOPMENT.—Mr. G. P. Graham, Minister of Railways and Canals, announces that an agreement has been reached between technical officers representing Canada and the United States as to the questions to be investigated by the enlarged joint engineering board which will report upon the proposed St. Lawrence navigation and water power development. Under the arrangement arrived at between the two countries the terms of reference will now go to the respective national advisory committees, to be reported upon by them to the Governments of each country, which will have final powers. The instructions to the engineering board are thus within measurable distance of ratification, and it is expected that a few weeks, at the most, will see the examination of the project upon an engineering basis, actively under way.—*Reuter* (Ottawa).

Cleethorpes.—ELECTRICITY SUPPLY.—At a recent meeting of the Town Council it was reported that a sub-committee had met the Grimsby Corporation Electricity Committee with reference to a supply from the borough. The terms on which the Grimsby Corporation would supply the Council with the additional energy required had been received, and the Lighting Committee recommended that these be submitted to the Council's consulting engineer for his report, on receipt of which a special committee could be convened.

Colne.—ELECTRICITY CHARGES.—The Electricity Committee has considered the adoption of an alternative tariff for electricity for lighting, chiefly for day-time use, and has instituted the following tariff from January 1st:—Fixed charge per quarter of 3s. per 40-watt lamp (or its equivalent) installed, and 2d. per kWh for all energy used. The Committee also considered the revision of existing scales for electricity so as to eliminate the percentage increases now in operation. A revised scale will come into operation as from April 1st.

Continental.—FRANCE.—In the report just issued by the Société d'Electricité de Paris for the year ending June last, reference is made to the new arrangements which have been made for the supply of electricity to the Paris municipality and to the Paris Metro underground railways. Satisfactory terms, to date from January 1st, 1923, have been arranged, the company having secured the cancellation of an option on part of its undertaking, held by the Paris Municipality since 1907, and an additional supply contract from the Metro, which will close down its own generating station at Bercy. In order to provide for the additional supply, the company is now taking steps for the establishment of a new central power station in the Paris district, to carry out which, a new company known as the Société Electrique de la Seine has been formed. The report adds that the output of the power station at St. Denis advanced from 190,228,050 kWh in 1922-23, to 209,937,254 kWh in 1923-24.

AUSTRIA.—As from January 1st the Vienna Municipal Council has reduced the charge for power by 12½ per cent., in connection with the inauguration of the new hydro-electric station of Opponitz, the working of which is expected to effect an annual saving of 75,000 tons of coal. A further reduction in the charges for energy is expected to result on the completion of the Kjenberg-Gaming hydro-electric works, the costs of which are to be defrayed partly out of the water power tax, which is also being levied for 1925.

SWEDEN.—The Swedish Water Power Association, reporting on the work executed in 1923, states that hydro-electric installations representing a total of 26,500 h.p. were completed for private account during the year, and plant for 47,500 h.p. was in course of erection at the end of the year also for private persons. The capacity of the State works was increased by 720 h.p. at the Stadsfors power station, and plant for 30,000 h.p. was being erected as the first instalment at the Lilla Edet station. At the close of 1923 water-power plant represented a total of about 1,350,000 h.p.

Dover.—YEAR'S WORKING.—The report of the borough electrical engineer (Mr. R. C. Harpur) on the working of the electricity undertaking for the year ended March 31st last shows that the total revenue amounted to £47,073, as compared with £49,914 in 1922-23. Working expenses were £25,610, as against £19,542, leaving a gross profit of £21,465 (£30,372). After deducting capital and other charges there was a surplus of £355, against which, however, was charged an adverse balance from the previous year of £1,029, leaving a net deficit of £674. During the year £21,998 was spent on capital account, the chief item being £12,432 for plant and machinery. The sales of electrical energy increased from 1,786,017 to 2,339,394 kWh.

Dutch East Indies.—HYDRO-ELECTRIC DEVELOPMENT.—A special department has recently been established at Bandoeng, Java, by the Dutch Government, to study the water power resources of the Dutch East Indies for the generation of electricity. It is estimated that 500,000 h.p. is available on the Island of Java, 2,000,000 h.p. in Borneo, 1,000,000 h.p. in Celebes, and 2,000,000 h.p. in Sumatra.

India.—ELECTRICAL DEVELOPMENT.—Recent reports from the Punjab indicate considerable progress in the use of electricity in the province. The plans of the Mandi hydro-electric project have been completed. Orders in connection with the electricity supply to Multan have already been placed. The construction work at Jullundur, as also at Rawalpindi, is well in hand. The Amritsar Muncipality is extending its plant, while at Lahore proposals for radical extensions are under consideration. Schemes for a supply in the towns of Gujranwala, Lyallpur, and Hissar have been prepared, and application has been made for licence. The Irrigation Department has placed orders for plant for two more power stations at Ferozepore Weir Division and Nalagarh. Specification designs for these were prepared by the Electrical Engineer to the Government. Similarly, work on the Industrial Department power station at Shahdara is well in hand, the overhead mains having been erected and the power house building almost completed.

Irish Free State.—SHANNON SCHEME.—In the Irish Free State Parliament recently Mr. McGilligan, Minister of Industry and Commerce, announced that the Continental experts who had been investigating, on behalf of the Government, the possibilities of the provision of water power for electrical purposes in the Free State had reported in favour of the Siemens (Berlin) scheme for harnessing the River Shannon. They had, however, made a few modifications. The experts state that the development of the Shannon would greatly improve navigation between Lough Derg and Limerick. Arrangements are contemplated for the protection of the fisheries. Another point referred to is that, while the Free State does not possess extremely large water power, the coincidence between water quantities and energy demand is exceptionally good, while all the costs, as calculated, compare favourably with costs in other countries. Mr. McGilligan stated that German financial backing for the Shannon scheme was not contemplated, and added that the question whether it should be a State or a private scheme had not yet been decided.

THE RIVAL LIFFEY INQUIRY.—Before the Free State Joint Parliamentary Committee on Private Bills, further evidence was given in support of the Dublin Electricity Supply Bill. Mr. G. Marshall Harriss, general manager of the Dublin United (Electric) Tramways Co., described the scheme embodied in the Bill as an admirable one. Senator H. S. Guinness, assistant managing director of Messrs. A. Guinness, Sons & Co., the famous brewing firm, said that both from an engineering and a financial standpoint he regarded the scheme as sound.

Mr. L. J. Kettle, Dublin city electricity engineer, said if the scheme propounded by Sir John Griffith were accepted by the Government the cost of electricity to the consumer would be increased. The present cost per kWh was 1.13d., exclusive of capital charges. A sum of £1,100,000 was sunk in the works, and 12,300 consumers were supplied. Witness could not advise the Corporation to take a supply from the promoters of this Bill.

In opposing the Bill, Mr. Jellett, K.C., for the promoters of the East Leinster Electricity Bill, said they had had no evidence from anyone who had constructed the scheme which it embodied.

Evidence was given by Mr. D. E. G. Binnie, a member of the firm of Sir Alexander Binnie, Son & Deacon, consulting engineers, who said that the East Leinster scheme was more satisfactory. The supply companies could not get the flow that they anticipated. Mr. Leonard, K.C., for the Wicklow County Council, asked that the financial clauses of the Bill should make provision for adequate compensation for disturbance and loss of industry in areas affected. At a later stage evidence was called on behalf of the Liffey salmon fishing interests, which, it was said, would be gravely menaced by the adoption of any of the schemes. The Committee adjourned until a date to be arranged in the New Year.

CLONMEL (CO. TIPPERARY).—The Government has sanctioned the electricity scheme for the town, and work has commenced on the erection of the power station.

Keighley.—LOANS SANCTIONED.—The Electricity Committee has received sanction to borrow £5,600 for the new main transmission line to Bingley, and £26,276 for mains and services. It is proposed to add a duplicate feeder to the existing ducts from the Keighley power station to Ingrow, at a cost of £1,200, and to construct a duplicate overhead transmission line from Ingrow to Oakworth, at an estimated cost of £1,800.

Luton.—LOAN.—The Corporation has decided to apply for sanction to borrow £42,010 in connection with the supply of electricity to Dunstable, Leighton Buzzard, and Leagrave.

Northern Ireland.—LONDONDERRY.—The Corporation has adopted a scheme for the free wiring of about 2,000 houses. The proposal is to introduce slot meters, rent to be covered by a charge of 1½d. per kWh. Capital outlay is stated at £33,200, and the revenue estimate is £13,333.

Price Reductions.—SIDMOUTH.—Lighting: A reduction of 1d. per kWh from 50 to 100 kWh per quarter, 2d. up to 200 kWh, 3d. up to 300 kWh, and a reduction of 4d. per kWh beyond 300 kWh per quarter. Power: The charges to be half the lighting rate with a minimum payment of 10s. per quarter.

LLANDUDNO.—Reductions subject to the completion of a new contract for the supply in bulk by the North Wales Power Co.:—Lighting: From 6d. to 5½d. per kWh. Power and heating: From 2½d. to 1½d. per kWh.

South Africa.—JOHANNESBURG.—The Provincial Executive has refused to grant the Johannesburg Municipality leave to borrow £525,000 to erect a new power station. The Executive, in a letter to the Municipality, points out that it would not be in accord with the Electricity Supply Act, if an independent power station of 39,000 kW capacity were to be erected adjacent to an interconnected electrical system, fed from five large generating stations of an aggregate capacity of 215,000 kW. It is not prepared, however, to say on the evidence at present available that the scheme should finally be rejected. It suggests, therefore, that the consideration of the scheme should be held over till further information is available as to the success or otherwise of the policy laid down in the Act, and of the operations of the Electricity Supply Commission.

JAGERSFONTEIN.—According to the *South African Power Engineer* the New Jagersfontein Mining & Exploration Co., Ltd., is to erect a new power station. The plant will include two Belliss-Swedish G.E.C. turbo-alternators, each with a capacity of 1,500 kW, and three Babcock & Wilcox 200-lb. water-tube boilers, fitted with superheaters and chain grate stokers. Electricity will be generated at 2,200 volts, 3-phase, 50 cycles.

FORT BEANFORD.—The Municipal Council is to erect a new power station for the supply of electricity in the town, and has appointed Mr. A. S. Chalmers, municipal engineer, of Alice, as consulting engineer.

Southend-on-Sea.—LOANS.—The Town Council has received sanction to a loan of £25,000 for house services. Further loans of £10,000 for feeders and distributors and £30,000 for house services are to be applied for. The Commissioners have also sanctioned extensions to the plant at the London Road generating station by the installation of a 750-kW Diesel engine.

Tramway and Railway Notes.

Continental.—ITALY.—Among new electric railways proposed are the Soresina-Sesto-Cremona of the Società Nazionale di Ferrovie di Roma. The estimated cost is 4,299,114 lire, and the works of construction are to be concluded within 18 months. A second electric railway officially sanctioned is the Mantova-Peschiera, the cost of the construction of the permanent-way of which is estimated at 9,343,938 lire. The ultimate cost of the lines, equipment, rolling stock, &c., has not yet been settled. A year has been fixed as the period within which this first portion of the undertaking is to be completed. A third electric railway authorised is that to serve part of Genoa, which it is estimated will cost 29,400,000 lire, and will take ten years to complete.

NORWAY.—Mr. Schreiner, chief engineer of the electrical department of the Norwegian State Railways, recently paid a visit to Berlin to attend the trials of the motors for the four electric locomotives which are intended for the operation of the Ofot railway which connects with the Swedish frontier. Six locomotives are in course of construction for this railway, two of which are being built in Norway. Pending the completion of these works it is proposed to loan electric locomotives from the Swedish State Railways for the provisional operation of the Ofot line, which is already equipped for the purpose.

HOLLAND.—A scheme has been drawn up for the construction of a system of underground railways in Amsterdam.

SPAIN.—It is reported that the first underground railway in Barcelona was opened on December 30th.

Croydon.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking (manager, Mr. T. B. Goodyer) for the year ended March 31st last record a total revenue of £113,231, as compared with £153,012 in 1922-23. Working expenses, which included recoverable expenditure of £1,210, amounted to £123,250, leaving an adverse balance of £10,019. After providing for capital charges there was a net deficit of £25,543. In the previous year there was a deficit of £9,140. A sum of £122,729 was spent on permanent-way during the year. The number of car miles run decreased by 47,369 to 2,240,584, and the number of passengers carried by 2,926,892 to 19,946,512.

India.—RAILWAY ELECTRIFICATION.—The *Englishman* of Calcutta states that the report of the British engineering experts requested by the Government of India to examine the possibility of electrifying the suburban lines of the East Bengal and East Indian railways feeding Calcutta, has now been received. The next step is the appointment of Major R. H. Stallard, R.E., to consider the experts' recommendations from the financial standpoint. The scheme applies to the sections between Bandel and Howrah on the East Indian and Kanchrapara and Diamond Harbour on the East Bengal systems, the distances being 30 and 150 miles respectively. This scheme is one of the biggest of its kind yet contemplated by the Railway Board. Owing to the approaching transfer of the East Indian Railway to State management, the project is expected to undergo modifications so as to make it a joint and co-ordinate undertaking. The question of a central railway station in Calcutta near the business quarter has thus been revived.

Java.—RAILWAY ELECTRIFICATION.—The first electric trains between Meester Cornelis and Tandjong Priok, the port of Batavia, situated a few miles from that city, will be opened for passenger traffic on June 1st, 1925. When that system is started a beginning will be made with the electrification of the Batavia-Buitenzorg line.—*Indian Engineering.*

Liverpool.—TRAMWAY EXTENSIONS.—The Ministry of Transport has made an Order for new tramway extensions of a length of 3¼ miles. At the next meeting of the City Council further attention will be given to the scheme for an extension to Ullet Road.

Southern Railway.—ELECTRIFICATION.—In connection with electrification of the South-Western section of the Southern Railway a sub-station is shortly to be erected at Guildford. There will be other sub-stations at Effingham, Epsom, and Dorking, the main power station being at Wimbledon.—*Modern Transport.*

West Ham.—LOAN SANCTIONED.—The Town Council has received from the Ministry of Transport sanction to a loan of £15,209 for tramway reconstruction and the provision of new bogie cars.

Telegraph and Telephone Notes.

Communication with Ships.—"WIRED-WIRELESS" PROPOSAL.—With the help of the German Government, German steamship companies are to make an effort to keep all passengers in continuous touch with their homes. The newest and largest German lines are being fitted with arc transmitters, and with broadcasting apparatus that will enable passengers on board to have two-way conversation with anyone by a telephone. Broadcast messages from the ships will be received at points on the German mainland, which will be linked with German central telephone exchanges by land lines. As the Germans will probably apply for Government permission to link up with Britain and the United States in the same way, steamship companies in those two countries are discussing whether they shall make a prior claim for the facilities from the British Government. The United States Government has already given such facilities to the United States liner *Leviathan*, which has communicated its own land telephone exchange at Deal Beach, 49 miles from New York.

A similar scheme is in successful operation in Sweden. Subscribers on the island of Bornholm are using such a service which works well, says the *Daily Mail*, without interference with other radio users.

Continental Telephony.—LONDON-BERLIN SERVICE.—With reference to the trial of the direct telephone line *via* Emden between London and Berlin which was referred to last week, it is stated that the results obtained were better than any hitherto secured in the various tests which have been made in direct telephony *via* Holland, but it would seem that any regular direct service is out of the question in the immediate future.—*Reuter* (Berlin).

Germany.—SHORT-WAVE TELEGRAPHY.—German keenness for research into short-wave wireless transmission has resulted, according to the *Daily Mail*, in the Nauen station exchanging messages with Buenos Aires. This is believed to be the first short-wave two-way communication between Europe and the Argentine. Nauen has recently been sending widely on a wave-length of 90 metres, and the reduction to 30 metres is significant. Successful laboratory tests have been made recently in Germany with wave-lengths of less than a metre.

Panama.—TELEGRAPH SERVICE.—In reporting to the Department of Oversea Trade on the economic, &c., conditions of the Republic, Mr. R. Keith Jopson, British Vice-Consul, points out that the telegraph service of the Republic has been considerably improved during the past few years; there are 31 telegraph stations in the principal towns, besides a long-distance telephone service, consisting of 105 stations, which connect the smaller towns with the capital. Practically all the towns of the Republic, except those in the Provinces of Darien and Bocas-del-Toro, are in direct communication with the capital city either by telegraph or by long-distance telephone. The distance covered by the National telegraph lines is 3,687 kilometres, and by long-distance telephone lines, 1,095 kilometres. The old wires have now been replaced by new copper wires strung on iron posts.

(*Continued on page 23.*)

The Tasmanian Hydro-Electric Undertaking.

Rural Electricity Supply Development.

We have received from Mr. J. H. Butters, chief engineer and general manager of the Tasmanian Government Hydro-Electric Department, a copy of his report for the year ended June 30th last, together with branch reports.

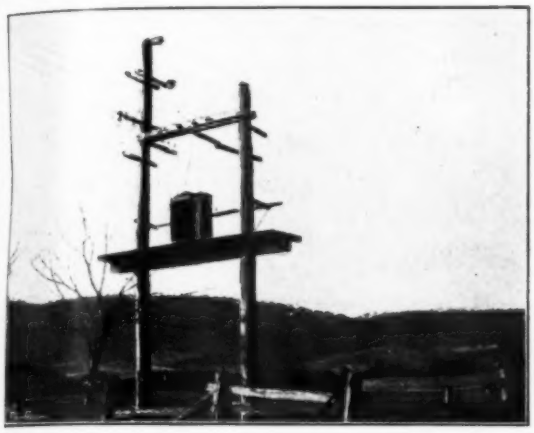


Fig. 1.—A Three-Phase Transformer Point in a Rural Service.

Fig. 2.—A Single-Phase Point in the Derwent Valley Service.

The whole of the Department's plant and equipment operated satisfactorily during the year. Considerable progress was made in rendering power available to country districts. The operation and maintenance of the rural lines on an economic basis is not a simple problem, but the Department has been able to inaugurate the service satisfactorily and hopes to be able to continue to serve the country and other districts in a manner beneficial to consumers. During the latter half of the year the Devonport steam plant was brought into use, but up to the date of the report this station had not secured the pumping plant and other loads which had been anticipated. As from the beginning of the year under review, the whole of the capital expenditure upon the completed Waddamana development was transferred to the capital account, and full interest and depreciation charges for the year have been borne. At the end of the year the total capital expenditure upon the bulk supply branch amounted to £2,671,625.

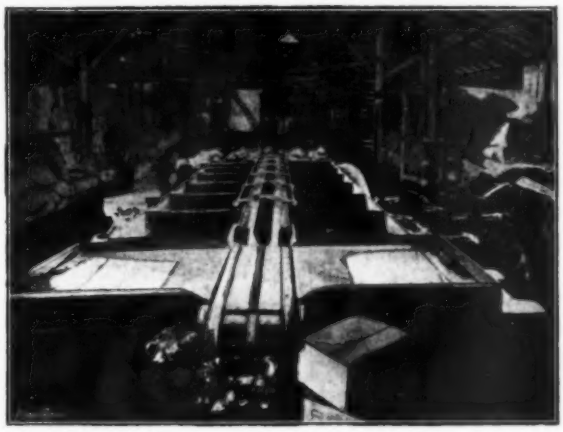


Fig. 3.—Electrical Apple Grading.

The revenue increased by over £50,000, but by the exercise of economy the working expenses were slightly reduced, making the gross profit £129,036, an increase of over £51,000. The financial results of the first country district service were so satisfactory as to lead to the expectation that by the end of the second year of working it will be paying in full for the power used as well as for interest, depreciation, &c. As regards the other country districts, although a temporary 6,000-V service has been arranged, the work has been delayed by the non-delivery of the 11,000-V transformers. The capital expenditure upon the Hobart District branch of the Department stood at £266,110 at the end of the year. The revenue of this branch increased by £18,000 to over £96,000, and in this case also expenses were reduced, leading to an increase of 30 per cent. in

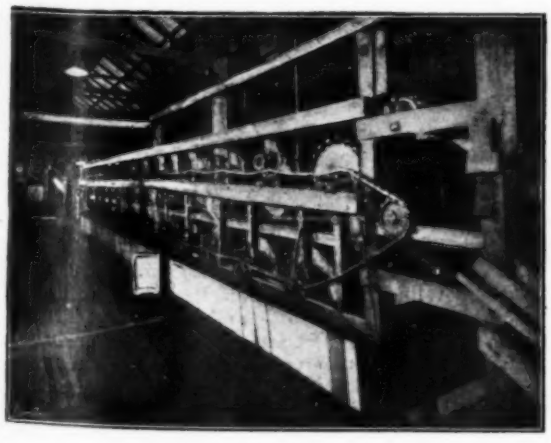


Fig. 4.—An Electrical Hop-Picking Machine.

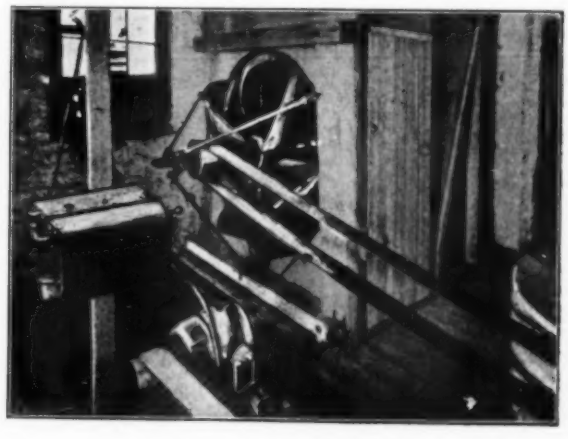


Fig. 5.—Hop-drying by Electricity.

the gross profit—to £42,271. The domestic load of this branch showed a remarkable development during the year. A list is given of the appliances sold by local dealers; this includes 1,100 radiators, 85 ranges, 250 hot-water systems, 803 irons, and 249 kettles. In Hobart and its suburbs there are now 180 ranges and 500 hot-water systems in regular use.

The consolidated accounts of the Department show that, after meeting all expenses of operation and management and a full year's interest and depreciation on all capital accounts, and making allowance for bad and doubtful debts, the net debit balance for the year amounted to £28,596, as against an estimated loss of £36,000. The financial success of the Department depends upon the disposal of the 14,000 h.p. which is still available. Mr. Butters says that it can be deemed to have been definitely proved that the Waddamana power development is a financial success. The output of this undertaking during the year was 276 million kWh, which is considered remarkable having regard to the restricted area of supply. Dealing with the Shannon scheme the report states that the necessary road work to the site has been carried

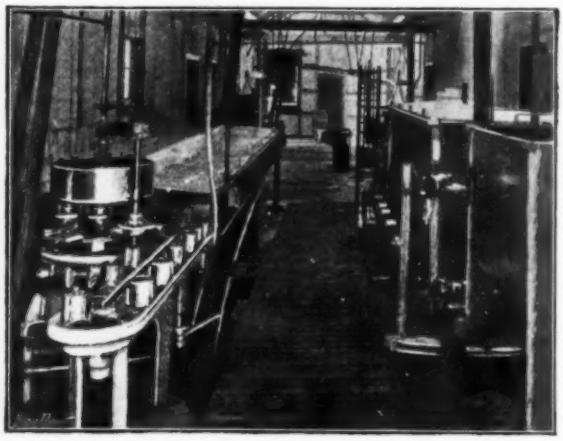


Fig. 6.—A Fruit Preserving Plant.

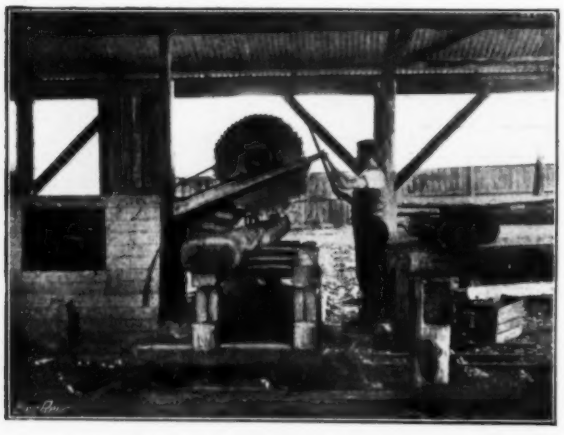


Fig. 7.—An Electrically-operated Saw.

out, and a certain amount of preparatory clearing work has been done at the power-station and pipe-line sites. A very satisfactory start has been made in

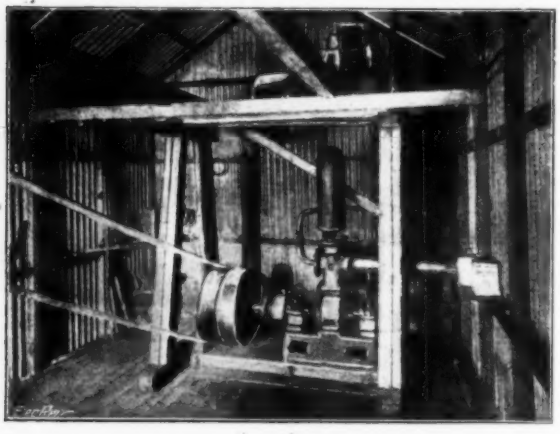


Fig. 9.—A Derwent Valley Pumping Plant.

spreading hydro-electric lines over the State. The Derwent Valley service has been carried to a point past the River Plenty. Fig. 1 shows a three-phase transformer point in this line, and fig. 2 a single-phase point. The rest of the illustrations will serve as a lesson to supply authorities and agriculturists in this country in the versatility of electrical service. Fig. 3 shows an apple-grading machine which is a helpful auxiliary in an important Tasmanian industry. Hop-picking and drying, tedious processes in England, are carried out by the equipment illustrated in figs. 4 and 5. Another important industry which has enlisted electrical aid is fruit preserving, which is carried out rapidly and hygienically by the plant depicted in fig. 6. The wood - producing industry uses the electrically-operated saw shown in fig. 7, and for the manufacture of wood wool the equipment which appears in fig. 8 is employed. One of many pumping installations in the Derwent Valley district is illustrated in fig. 9. There are also a number of electrically-operated dairies.

The Huon service has been completed to the townships of Cygnet, Kingston, Woodbridge and Kettering. The North Coast service is well towards Ulverstone from Devonport, while a start has been made on the Ulverstone-Penguin line. The West Coast service, covering a sub-station at Lake Margaret and a transmission line to Zeehan, is rapidly approaching completion. Arrangements are being made by the Electrolytic Zinc Co. to take power as soon as it is available. Considerable new construction was carried out during the year in the Hobart district, a large portion of the 6,600-V area having been converted to 11,000 V. The Eastern suburbs of Bellerive and Lindisfarne were provided with a complete new service, involving a submarine cable and an 11,000-V pole line. In anticipation of a North Coast service a number of municipalities

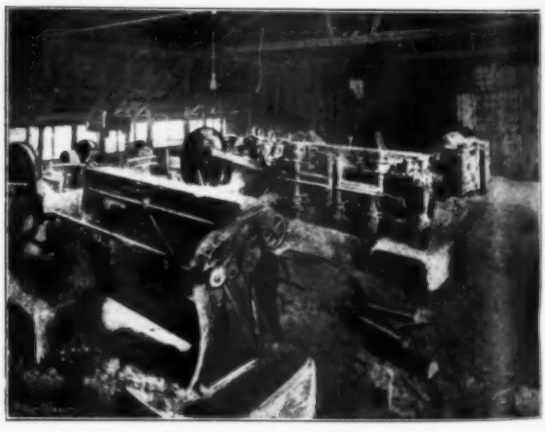


Fig. 8.—Wood Wool Manufacture.

have agreed to take power. During the year the business of the Carbide Co., which was under a receivership, was carried on by the Department.

The Amalgamated Zinc Co., having in sight the termination of its work at Broken Hill, has decided to take up the production of pulp and paper. The Department will be called upon to supply 4,000 h.p. in the first year and a further 4,000 h.p. in the course of a year or two. It is proposed to meet the demand by means of a transmission line from Waddamana.

The report of the Country Districts Branch states that the extent to which the Derwent Valley load, principally of a rural nature, has grown is very gratifying. In New Norfolk in every case in which internal-combustion or steam engines were formerly employed to drive pumps, milking machines, fans, and hop-picking and wood-working machinery they have been replaced by electric motors.

The World's Largest Engineering Project.—II.

The Undertaking of the Southern California Edison Co.

By T. B. ROSS.

In attempting to give readers a short description of the many accomplishments which the electrical department of the Southern California Edison Co has already to its credit, one can only briefly cover these in a single article. It would require a fair-sized volume to deal adequately with all the electrical operations of the company, but the writer will endeavour to confine his description to the matters of most interest to the electrical engineer concerned in power distribution and its many side issues. Dealing with the high-voltage lines from Big Creek, the pressure on these was increased during 1923 from 150,000 volts to 220,000 volts to take care of the increased demand for energy following the phenomenal growth of Southern California during the past 10 years. The company had two courses to choose from in meeting this greater demand: (1) Either to construct a duplicate set of transmission lines carrying 150,000 volts, or (2) reconstruct the existing lines with a capacity for the higher figure. The latter method, after careful calculation by the company's engineers, was proved the better plan, and by its adoption an estimated saving of roughly $7,000,000 was made over the duplicating plan. Its adoption, however, meant the overcoming of numerous obstacles. The electrical manufacturers were able to build transformers to operate at the higher voltage, but the question of insulation and re-designing of the lines called for much thought and experiment before the company could proceed with its new plan.

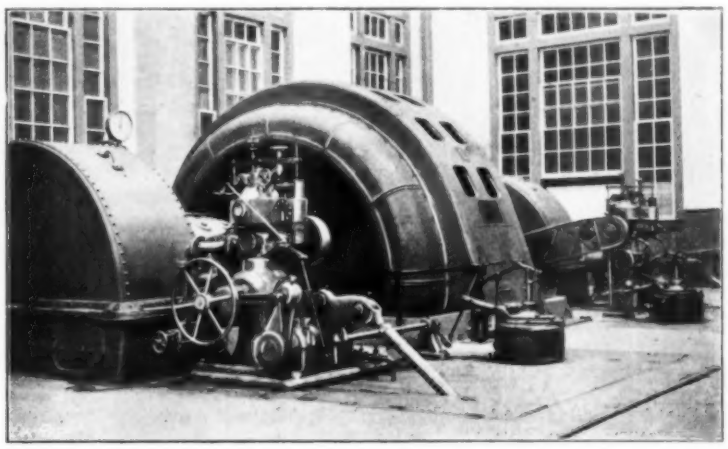


Fig. 1.—No. 1 Generating Set (14,000-kW at 375 r.p.m.), at Power House, No. 1, Big Creek.

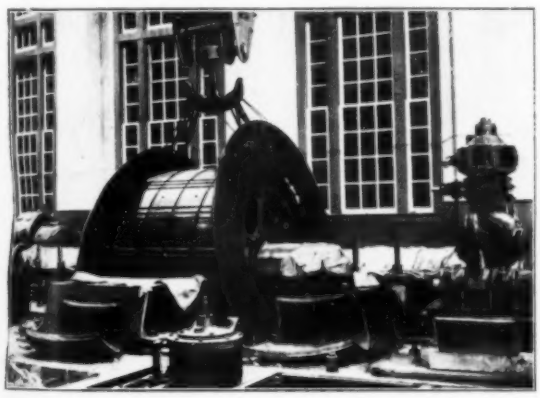


Fig. 2.—Third Set in Course of Erection at Big Creek, No. 1.

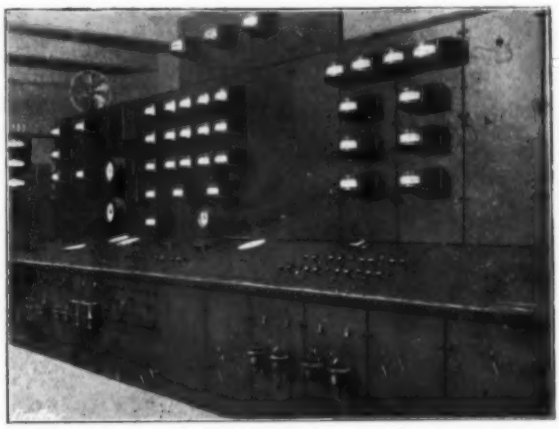


Fig. 3.—Switchboard at Power House, No. 1, Big Creek.

In seeking for the best system of insulation, the Edison Co., working in conjunction with Professor Ryan, of Stanford University, first carried out many tests on different combinations of insulators with and

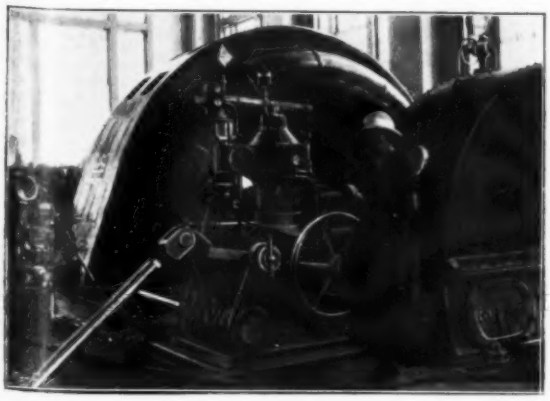


Fig. 4.—Mrs. Heckman Starting No. 3 Set, July 4th, 1923.

Fig. 5.—Power House No. 1, Photographed at Night by "Flood Light."

without different types of shielding devices. It was found that by placing a metal shield ring around the insulator next to the conductor and by adding two insulators to the string, sufficient insulation could be obtained for the higher voltage. Later, a section of the Big Creek line, 27 miles in length, was taken out of service and equipped with the new shield rings. At the commencement the section was energised at 280,000

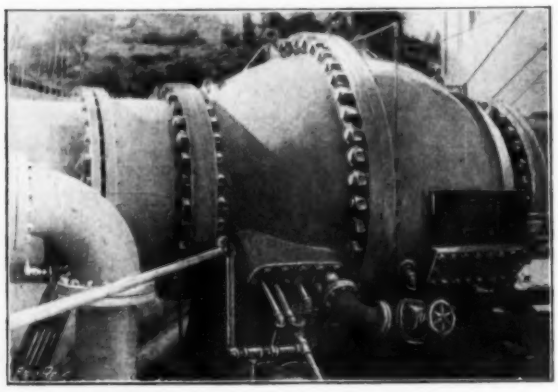


Fig. 6.—Hydraulic Valve at Camp 3, Big Creek.

volts without any apparent harm, after which the pressure was reduced to 240,000 volts, and this voltage was maintained for about one month, with complete success. The company therefore felt that no difficulty would be experienced when the whole of the Big Creek system was converted to 220,000 volts. But there were certain obstacles to be overcome in carrying out the work, one being the matter of ground clearance, con-

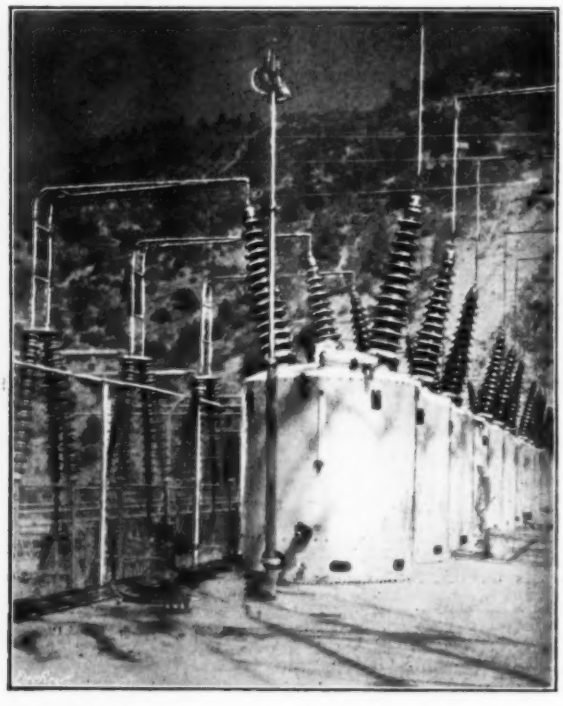


Fig. 8.—220,000-volt Switches at Power House, No. 3, Big Creek.

siderably reduced by the additional strings of insulators. This was effected by raising the towers, whilst the line was hot. It was also found necessary to install banks of 150,000- to 220,000-volt auto-transformers at each 150,000-volt power house and sub-station, the auto-transformers being connected solidly in the line. Each line has its own bank of transformers, capable of carrying the total load of the station to which it is connected, and all switching is done on the 150,000-volt side. The auto-transformers are each fitted with a tertiary winding, and are connected in delta to supply a path for any third harmonic present in the voltage wave, thus avoiding the high insulation stress which would otherwise exist. The work was finally completed in May, 1923. Most careful attention had to be given during the various steps in the cut-over from the lower to the higher voltage, which was carried out during the quiet hours obtaining from 8 p.m.

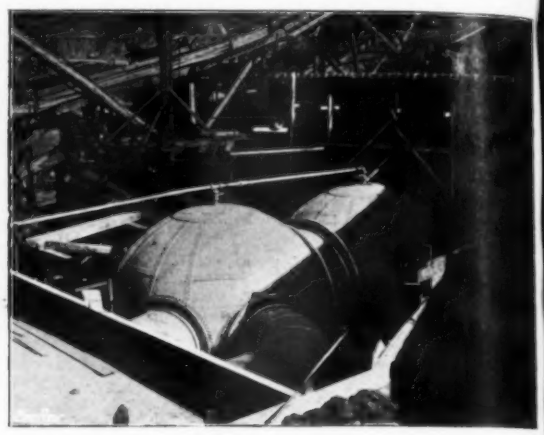


Fig. 7.—Manifold at No. 3, Big Creek, connecting six Penstocks, 7½ ft. in diam. to 18 ft. steel pipe at mouth of tunnel. Head 200 ft.

Saturday to 5 a.m. Sunday, May 5th-6th. The 30,000-kVA condenser at Eagle Rock (a small town outside Los Angeles) formerly operated on the 150,000-volt line at 50 cycles, and this had to be brought into step with the

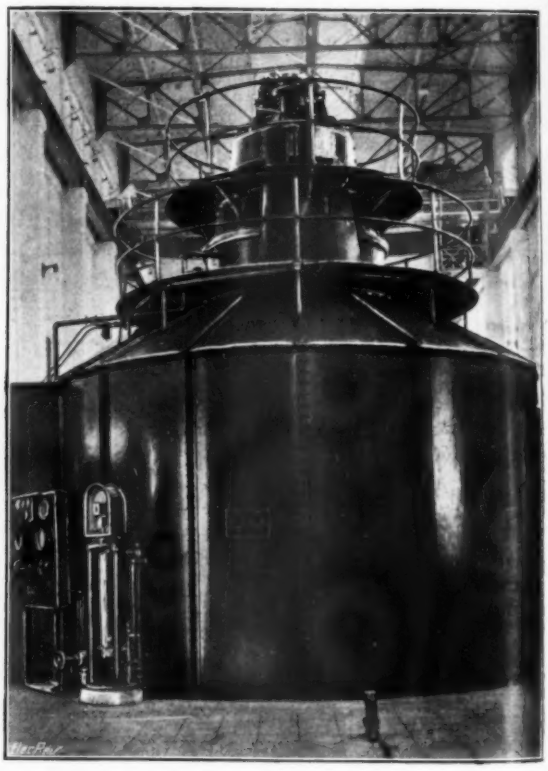


Fig. 9.—No. 1 Generating Set at Power House No. 3, Big Creek: 35,000 h.p., 428 r.p.m. Head 740 ft.

generator at Power House No. 8, Big Creek, generating at 35 cycles, the voltage being increased from 150,000 to 220,000. This was accomplished by disconnecting the condenser and allowing it to coast down to about 35 cycles, at which speed it was connected to the B.C. line. Then the voltage was increased at Power House No. 8 to 220,000. The next step was to synchronise at Eagle Rock the West B.C. line with the East B.C. line and with the general Edison system. Finally the East and West lines at B.C. 2, 150,000 and 220,000

volts respectively, were paralleled, and the following week-end the same programme was carried out to bring the East B.C. line into operation at 220,000 volts.

By this conversion it is estimated that on completion of the B.C. project, $50,000,000 will be saved in the cost of constructing transmission lines, or, calculated in light and power charges, a reduction of over £1,000,000 per annum to consumers will be effected.

The many sub-stations operating throughout the company's supply area carry voltages ranging from 60,000 down to 15,000 volts.

Alhambra, one of the largest sub-stations and lying between Los Angeles and Pasadena, is (or was) being enlarged to carry three 60,000-volt lines, tying in the smaller sub-stations of Eagle Rock, Nemark and Dalton (all practically within the Los Angeles area). Transformation is being effected there by transforming from 60,000 to 15,000 volts for distribution over five 15,000-volt circuits, which will be effected by the outdoor installation of a bank of transformers rated at 9,000 kVA. Large type oil switches are employed, electrically operated by remote control.

At Laguna Bell sub-station (about six miles south-east of Los Angeles) the terminal station for the 220,000-volt lines, transformation for 120,000 kVA from 220,000 volts to 60,000 volts is provided. A 30,000-kVA condenser is also installed for regulating the 220,000-volt lines. Twelve 60,000-V lines will radiate from this new terminal station.

In addition to the above supplies, three new synchronous condensers are being installed at Eagle Rock and Laguna Bell stations, which will increase the condenser capacity for each station to 90,000 kVA.

Big Creek Power House No. 3 (the electrical giant of the West), when completed, will operate at 220,000 V, with 196,000 V at Eagle Rock and Laguna Bell, delivering 98,000 kW to Laguna Bell and 90,000 kW to Eagle Rock at 80 per cent. power factor, giving 63,000 V on the distribution buses at both sub-stations. These three additional condensers have been found necessary to take care of the added 100,000-kVA generator capacity from Big Creek. The company states that it requires approximately 1 kVA of condenser capacity for each kW delivered from Big Creek to Eagle Rock or Laguna Bell, and that the ratio of condenser to generator capacity could be decreased 30 per cent. if the power factor could be increased to 90 per cent.

In such an enormous system of transmission lines, difficulties of different localities have to be contended with, and particularly where the company's lines traverse the coast sections, insulation troubles call for special protecting methods against sea fogs. It is stated that 40 per cent. of the 60-kV transmission system is embraced in the fog belt area, and to overcome the lowering of insulation resistance caused by the accumulation of salt and dust on the porcelain insulators additional insulators have been added to all suspension strings, thereby removing the liability of the flashovers formerly experienced, which caused serious interruption in the system. The writer saw the results of such a flashover in the operating department at B.C. Power House No. 1. Huge chunks of brass and copper were fused and blown a distance of many feet, and large pieces of concrete were split and scattered about the main switchboard room, the operator on duty at the time having a narrow escape from serious injury. The new 60-kV lines are all composed of No. 4/0 copper and the older lines are also being changed to this size.

(To be concluded.)

Shop-Window Lighting after Closing Hours.—The movement towards the later use of artificial light in shop windows inaugurated by the E.D.A. some two years ago continues to progress in a satisfactory manner. The Association now suggests to supply undertakings that where they have showrooms, or any windows giving on to public streets, where some display can be made by means of electric light, they should give up a portion of the window space to a simple and bold presentation of the case for the later lighting of shop windows.

Telegraph and Telephone Notes.

(Continued from page 18.)

Panama.—CABLES.—The West India & Panama Telegraph Co.'s offices in Panama and Colon were closed on July 31st, 1924. No new stations in the Republic have been opened by All America Cables Inc. Communication has recently been established between Balboa and Punta Arenas, on the Pacific seaboard of Costa Rica, and there have been numerous reductions in rates between Panama and the Republics of Central America, and several European countries; rates to Great Britain, however, have remained unchanged.

RADIO TELEGRAPHY.—The laws of the Republic and the Canal Zone restrict operations to the control of the United States. The system of radio communication operated by the Navy Department on the Isthmus consists of six stations. The only other commercial station in Panama is that of the United Fruit Co. at Almirante, for which a special licence has been obtained. The naval equipment consists of a high-power station at Darien; the two stations at Balboa and Colon, at each end of the Canal; and three outlying stations at Punta Mala, on the western side of the entrance to the Gulf of Panama; La Palma, diagonally opposite, on the Bay of San Miguel; and Puerto Obaldia, on the Atlantic coast, two miles from the Colombian border. The Darien station has three 600-ft. pyramidal towers, standing at the apexes of an equilateral triangle with a base of 900 ft. Its 100-kW plant has a normal sending radius of 3,000 miles, and is employed in the transmission of messages to the Navy Department in Washington, to San Diego, California, and in other long-distance service; this station has been heard in Australia, 7,000 miles distant, and by a ship passing from Colombo to Aden, approximately 12,000 miles away. The Balboa station transmits and receives about 15,000 words of commercial traffic per month, Colon 16,000 words, and Punta Mala 3,500. No commercial messages between Panama and the United States are accepted by the naval stations.

Mexico.—TELEPHONE OVERHAUL.—The telephone system in Durango requires overhauling, says *Commerce Reports*, and it is probable that much of the overhead cable will soon have to be replaced.

Radio Notes.

Aerials.—KEIGHLEY.—The Housing Committee recommends the Town Council to refuse to allow radio aerial wires to be fixed on Corporation property—including municipally-built houses—without written permission, and that when permission is granted, in all cases where the installation involves going on to the roof a charge of 10s. be made.

Broadcasting Plays.—AN INJUNCTION.—In the Chancery Division recently, Mr. Henn Collins, for Messrs. Harms Incorporated, an American company, moved for an injunction to restrain the Savoy Hotel, Ltd., from infringing its copyright in the musical work "Nono Nanette" by permitting the performance in public of the two pieces "Tea for two" and "I want to be happy." Mr. Jolly, for the Savoy Hotel, applied for an adjournment until next term. Mr. Collins said he would consent to an adjournment if the Savoy Hotel would give an undertaking in terms of the motion. The play was due to be produced in London, and its eyes, so to speak, were being picked out by the playing of the two pieces by the Savoy Band, whose performances were being broadcast. Mr. Justice Eve said he would give the American company an injunction over the first motion day next sittings to restrain the Savoy Hotel. The motion would stand over until next sittings. On the following day, Mr. Gover, K.C., for the Savoy Hotel, moved to discharge the interim injunction granted the day before. The person the Harms Co. ought to sue was Mr. de Morny, who had the independent direction of the band. Mr. Justice Eve discharged the order.

Canada.—LICENCES.—The radio branch of the Department of Marine issued nearly seventy thousand receiving licences during the first eight months of 1924, being an increase of six thousand compared with the same period in 1923. Approximately seventy-five thousand radio receiving licences are actually in operation in Canada now.—*Reuter* (Ottawa).

WAVE LENGTH RESERVED.—The radio branch of the Department of Marine announces that the wave length of 125 metres is being specially reserved for Canadian amateur transmitting stations for trans-Canadian inter-Dominion radio work.—*Reuter* (Ottawa).

Irish Free State.—BROADCASTING CONFERENCE.—The Radio Association of Ireland has decided to call an All-Ireland Conference on broadcasting, to which it is proposed to invite representatives of the Royal Dublin Society, the Institution of Electrical Engineers, the Irish Post Office, and other bodies, to frame a scheme and submit it to the Minister for Finance. At the meeting, Mr. D. O'B. McAteer, A.R.C.Sc.I., said that the Post Office in the Free State had assumed control of all radio telegraphy, largely due to the fact that the Postmaster-General himself took a personal interest in the matter, because he believed there was a great future before it. The Postmaster-General was a supporter of a scheme for starting

broadcasting in Ireland by means of private enterpise rather than by the Government, which was in direct agreement with European experience on the subject. In his opinion, the British broadcasting system was the best, and it was foolish to say that they should not adopt anything that was British. He thought that Ireland should be represented at the International Wireless Congress to be held in Paris next April. It was estimated that the Postmaster-General collected £2,000 for setting up radio sets in Dublin under the 1904 Wireless Telegraphy Act, but the Free State Government could not authorise the erection of a broadcasting station that could be heard outside the country, this right being reserved to the British. He considered that they should have a central broadcasting station located in Athlone. There was some difference amongst the members as to whether the British Broadcasting Co. should be asked to erect a station in the Free State, and it was stated that any company prepared to make the venture should be encouraged.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Australia.—SYDNEY.—February 18th. New South Wales Government Railways. Four 3-phase, 25-cycle, 500-kVA transformers. March 11th. One motor-driven ash exhauster.*
February 4th. Public Works Department. Two motor-driven self-cleaning water screens.*

Barnes.—January 12th. Electricity Department. One 500-kW rotary or motor-converter, with transformer and switchgear. (December 19th.)

Belgium.—ANTWERP.—January 6th. Municipal authorities. Armoured cables in connection with the electric pumps at the Kattendyk hydraulic station. Particulars from Hotel de Ville for 2 fr.

Bournemouth.—January 9th. Corporation. Wiring, &c., for electric lighting at the Sanitary Hospital, Gloucester Road. (December 26th.)

Cardiff.—January 19th. Electricity Department. One water-tube boiler with mechanical stoker, one 320-tube economiser, and one chimney cooling tower complete. (December 19th.)

Dartford.—January 17th. Electricity Department. Extensions to the electricity department, including artesian well, 750-kW rotary converter, and e.h.p. and d.c. switchgear. (December 26th.)

Dundee.—January 19th. Electricity Department. A.c. and d.c. house-service meters for 12 months. (See this issue.)

Eastbourne. — January 8th. Electricity Department. Supply of h. and l.p. insulated cable for 12 months. (See this issue.)

Egypt.—CAIRO.—January 6th. General manager, Egyptian State Railways. Telegraphs and telephones, Cairo station. Supply of transformers, switchgear, and cables. Specification from the Stores Department, Saptia (Cairo) or Gabbary (Alexandria).

Glasgow.—January 13th. Corporation. Electric lighting, bells, telephones, and fire alarm installations in connection with the erection of the sanatorium at Mearns, Renfrewshire. Specifications from Office of Public Works, 64, Cochrane Street.
January 6th. Electric lighting installation in connection with the Balmoral Street, Scotstoun, and West Craigton housing schemes. Specifications, &c., from Mr. R. B. Mitchell, 75, Waterloo Street, Glasgow.

Halifax.—January 8th. Tramways and Electricity Committee. One 300-amp.-hour storage battery. (See this issue.)

Horwich (near Bolton).—January 15th. Installing electric lighting fittings in premises of Horwich Industrial Co-operative Society, Ltd., 86, Lee Lane, Horwich. Specifications from Mr. J. H. Wynn, general manager.

London.—CAMBERWELL, S.E.—January 12th. Borough Council. Six or 12 months' supply of electric lamps. Maintenance of electric lighting, heating and power installations, telephones, &c., for 12 months. Forms of tender from Mr. W. Bell, borough surveyor, Town Hall, Camberwell Green.
LONDON COUNTY COUNCIL.—January 19th. 3,700 tons of standard steel girder tramway track rails, lipless track rails and fishplates, and, alternatively, 4,700 tons of such rails and bolts; 700 tons of conductor tee rails. Chief Engineer, Old County Hall, Spring Gardens, S.W.
H.M. OFFICE OF WORKS.—January 20th. 900 a.c. prepayment electricity meters. (See this issue.)
BERMONDSEY.—January 22nd. Electricity Department. Stores for 12 months, including cables, jointing, &c., materials, conduits, meters, lighting and wiring accessories, &c. (See this issue.)
METROPOLITAN ASYLUMS BOARD.—January 28th. Alterations and extensions to electric lighting installations at the Western Fever Hospital, Seagrave Road. (See this issue.)

Manchester.—January 3rd. Electricity Committee. 62 electric wash boilers. (December 26th.)
January 14th. Electric street lanterns, switches and cut-outs, and electric cooking ranges. (See this issue.)
January 13th. Tramways Committee. Span-wire brackets, cast-iron finials, and copper bonds for tramway poles. Mr. H. Mattinson, general manager and chief engineer, Corporation Tramways, 55, Piccadilly, Manchester.

Salford.—January 7th. Electric lighting of kitchen and sculleries at Ladywell Sanatorium, including re-wiring, fittings, lamps, &c., complete. Particulars from Medical Officer of Health, 143, Regent Road.

Scarborough.—January 5th. Electrician's work required in connection with extensions to Corner Café, Peasholm Gap; public lavatories and shops adjoining; and public shelter and lavatories, North Bay promenade extensions. Forms of tender from Mr. H. W. Smith, borough engineer.

Sheffield.—January 3rd. Electricity Department. Materials and works for three transformer sub-stations. Mr. S. E. Fedden, manager.

Uruguay.—MONTEVIDEO.—February 12th. State Electricity Works. 104,500 metres of rubber-insulated cords.*
February 13th. Lubricating oils.*
February 16th. Copper wire and cable.*
February 17th. 745,000 metres of special cables for outside use under inclement conditions. (Hackethal type.)*
February 18th. 79,000 metres of lead-covered wires and cables.*
February 19th. 134,000 metres of v.i.r. wires and cables for indoor installations.*
February 27th. 3,000 d.c. meters and spares; 17,285 h. and l.p. a.c. meters and spares.*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—MELBOURNE.—Victorian Railways.
Copper cable (£325 and £336).—British Insulated & Helsby Cables, Ltd. Telephone apparatus (£1,101).—C. R. Foster.
Victoria State Coal Mine.
400-kVA transformers (£452 each).—Weymouths, Ltd.
State Electricity Commission of Victoria.
Ironclad service fuses (£1,815).—O. J. Nilsen & Co.
Insulator pins (£1,041).—McPhersons Pty., Ltd.
Additional switchgear for sub-stations B, C, and D (£7,400).—Australian General Electric Co., Ltd.
Steel conduit and fittings (£1,139).—Noyes Bros. (Melbourne) Pty., Ltd.
ADELAIDE.—South Australian Supply and Tender Board.
Electro-mechanical signalling material (£5,962).—General Railway Signal Co. Pty., Ltd.
5,000 ft. No. 8 soft-drawn copper wire, 15,000 ft. No. 11 rubber-covered wire, 20,000 ft. No. 16 ditto (£168).—Elder, Smith & Co.
X-ray unit, complete, at Port Augusta Hospital (£367).—W. Watson and Sons, Ltd —*Tenders.*

Belgium.—The Belgian State Railway authorities in Brussels opened tenders on December 17th for the supply of 21 lots of miscellaneous electrical material. One of the lots was for the supply of 10 kilometres of underground telephone cable, for which tenders were received from Belgian, Danish, German, and British manufacturers (Callender's Cable and Construction Co., Ltd., London). The offers ranged from 123,500 to 173,500 fr., the lowest being that of the Nordiske Kabel og Traat-fabriker, of Copenhagen.

London.—ADMIRALTY.—Accepted:—
Electric lamps.—Siemens & English Electric Lamp Co., Ltd.
MARYLEBONE. — London and North-Eastern Railway. Accepted:—
12 months' supplies of Osram and Robertson lamps.—General Electric Co., Ltd.
BOOTH STEAMSHIP CO. Accepted:—
Electric lamps for 12 months.—Siemens & English Electric Lamp Co., Ltd.

Leek.—Urban Council. Accepted:—
500-b.h.p. producer and auxiliary plant for the electricity works (£930).—National Gas Engine Co., Ltd.

Loftus.—Urban Council. Accepted:—
Installing electric light at the Isolation Hospital.—J. Walker.

Manchester.—Electricity Committee. Accepted:—
130 2-kW electric radiators for "All-Electric" houses on the Burnage Housing Estate.—Carron Co.

The Corporation Tramways Committee last week decided to reverse its decision to give the contract to the United States Steel Products Co. for tramway rails to the value of £1,800. The order will be placed with Hadfield's Steel Foundry Co., of Sheffield, whose tender was £85 more than that of the American firm.
At the last meeting of the City Council it was stated that the American firm did not observe trade union conditions of labour in its own particular district. Alderman Bowie, the chairman of the Tramways Committee, said the inquiry had

shown that the American company was not contravening the City Council's standing order on this point. The unemployment question here had always swayed the Committee in favour of the Sheffield firm.

In a contract for tramway poles the tender of a Czecho-Slovakian firm was £2,000 less than the lowest English tender, and this the Committee decided to accept, having satisfied itself that the provisions of the International Workmen's Convention were being observed.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended:—

12 tons 19/14 stranded h.d. bare copper wire (£1,127).—Telegraph Mfg. Co., Ltd.

Six each 5-, 7½-, 10-, and 20-h.p. motors and nine 15-h.p. motors (£1,096).—Kelley & Partners.

Six each 5-, 7½-, 10-h.p. special squirrel-cage motors (£462).—Langler and Co.

Forthcoming Events.

Institute of Transport.—Monday, January 5th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Paper on "Recent Developments in the Industrial Aspects of Transportation," by Brig.-Gen. H. O. Mance, C.B.

Roentgen Society.—Tuesday, January 6th. At 32, Welbeck Street, W. At 8.15 p.m. Paper on "Some Developments in Deep Radio-Therapy," by Dr. N. S. Finzi.

Electrical Society of Glasgow.—Tuesday, January 6th. At 30, Gordon Street, Glasgow. At 7.30 p.m. Paper on "Measuring Instruments and Testing," by Mr. C. W. Marshall.

Physical Society and the Optical Society.—Wednesday and Thursday, January 7th and 8th. At the Imperial College of Science and Technology. From 3 to 6 p.m. and 7 to 10 p.m. Annual exhibition.

Junior Institution of Engineers.—Wednesday, January 7th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Inaugural meeting. Address by the president, Dr. A. Russell.

(North-Western Section).—Monday, January 5th. At the Manchester Geographical Society, 16, St. Mary's Parsonage, Manchester. Presidential address, "The Outlook of Engineering," by Mr. A. P. M. Fleming.

Institution of Electrical Engineers.—Thursday, January 8th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Three-wire Direct-Current Distribution Networks: Some Comparisons in Cost and Operation," by Mr. H. W. Taylor.

(Wireless Section).—Wednesday, January 7th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "A New Method of High-frequency Resistance Measurement," by Prof. E. Mallett and Mr. A. D. Blumlein.

(Irish Centre (Dublin)).—Thursday, January 8th. At Trinity College, Dublin. At 7.45 p.m. Ordinary meeting.

(North-Western Centre).—Tuesday, January 6th. At the Milton Hall, Manchester. At 7 p.m. Joint meeting with the Institution of Post Office Electrical Engineers. Faraday Lecture on "World-wide Radio-Telegraphy," by Prof. G. W. Howe.

(Dundee Sub-Centre).—Thursday, January 8th. At University College, Dundee. At 7.30 p.m. Paper on "Telephone Cable Practice," by Mr. F. J. Lawson.

National Association of Supervising Electricians' Debating Society.—Thursday, January 8th. At Chalmers House, 43, Russell Square, W.C. At 7.15 p.m. Discussion on "The Effect of Trade Union Regulations on Industrial Output," to be opened by Mr. A. Brammer.

Edinburgh Electrical Society.—Friday, January 9th. At 4, Queen Street. At 8 p.m. Social evening and dance.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

EMPEE photographic arc lamps.

Notes.

Electro-Medical Apparatus.—The Devon and Exeter Cancer Fund Committee has decided to purchase, at a cost of £900, a spare deep therapy apparatus, which is to be installed in the electrical department at the Royal Devon and Exeter Hospital.

Electricity in French Mines.—A recent French report shows that there has been a steady decline in the amount of steam plant employed in the Pas-de-Calais in favour of electrical equipment. While in 1913 there was 127,762 h.p. of steam plant in use, in 1923 the aggregate was only 66,360 h.p. At the same time the electrical generating plant installed increased from 90,636 to 249,910 h.p. This increased capacity reflects the installation of a great deal of electrically-operated machinery—coal-cutting machines, pumps, ventilating equipment, air compressors, &c. In 1913 the number of "pieces" of electrical machinery in use in the mines of the Department was 73; in 1923 the total had risen to 2,828.

Electricity in Scottish Mines.—A special correspondent of the *Scotsman* points out that at no time in the history of the mining industry were more extensions being made than there are to-day to the electrical plant which is utilised for haulage and pumping purposes, while last year electrical winders were introduced at several collieries. He gives figures to show that the horse-power has been more than doubled since 1913, and says electric motors are being utilised on service roads as well as on main arteries, and so far as Scotland is concerned the majority of the conveyors and coal cutters are driven by electricity. Many of the pit bottoms and the main sidings, which are the underground "clearing houses," are lit by electricity. In the Victoria Colliery, belonging to the Lothian Coal Co., Ltd., at Newbottle, a lighting installation has just been introduced in a section at the faces. The innovation is an experiment, and developments at the colliery will be watched with a great amount of interest by mining experts throughout the entire country. Meanwhile all that can be said is that the experiment is a decided success so far as it has gone.

Appointments Vacant.—Assistant electrical engineer for service in England for the High Commissioner for India. Electrical mechanic for the Nigerian Government Railway (£380). Meter tester and inspector for the Shoreditch Borough Council Electricity Department. Armature winder for the Huddersfield Corporation Tramways. (See our Official Notices to-day.)

National Alliance and Extended Insurance.—The National Alliance of Employers and Employed recently requested the Prime Minister to set up a committee of Members of Parliament and representatives of other parties interested to examine and report upon the desirability and practicability of an "all-in" insurance scheme providing for sickness, unemployment, old age, widows and dependants. In reply, Mr. Baldwin stated that the financial questions involved in such a scheme could best be dealt with by the Government itself, and the responsibility could not be devolved upon any outside body. He added, however, that any suggestions submitted would be carefully considered.

Ontario Hydro-Electric Commission: Charges Investigated.—The New York *Electrical World* for Dec. 13th states that E. Clarence Settell, formerly private secretary to Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, has been found guilty of attempted stealing in connection with the cashing of a Hydro-Electric cheque for nearly $30,000 and has been sentenced to three years in the penitentiary. When Settell was arrested, while on the point of leaving Canada, he sent a letter to Sir Adam Beck which contained charges of wrongdoing against past and present engineers of the Commission. On the demand of Sir Adam Beck, an inquiry was instituted by the government. The charges were found to allege inefficiency and loose management rather than grave malfeasance. Some charges were trivial in their nature, and others met with emphatic denial.

The *Electrical World* for December 20th, which is just to hand, states that Judge Snider's report on his investigation of the charges contained in Settell's letter shows that only 19 out of 85 accusations are true or partly true. Our contemporary adds:—"Only charges of a very trivial kind against Sir Adam Beck are found to be substantiated. All of the important charges against the chairman, such as those involving wrongful expenditure of large sums of money for rental and furnishing of Sir Adam's apartments, disbursement of Hydro funds for the London sanatorium and forging of certain contracts, are found to have been false. Chief Engineer F. A. Gaby was found to have recommended the appointment of his brother to the medical staff of the Commission, and the sale to the Hydro Commission of a machine shovel from a plant owned by Mr. Gaby was condemned. I. B. Lucas, K.C., Hydro solicitor, was found to have shown 'censurable nepotism' in the conduct of the legal department, and sums paid by him for services rendered to the Hydro Commission were pronounced excessive."

Street Lighting in America.—Constituting the first step in modernising its entire street-lighting system, the city of Chicago has placed an order with the General Electric Co., of America, for 6,500 ornamental Novalux street-lighting units. Approximately 125 miles of thoroughfares are to be illuminated, at a cost of about half a million dollars. Chicago is giving as careful thought to its residential districts as to the down-town areas of commerce, which is a distinct departure from previous practice, as the tendency has heretofore been to neglect the residential avenues. Mazda lamps of 250 c.p. are to be enclosed in alabaster rippled globes, mounted on concrete octagonal poles, 12 ft. in height and 100 ft. apart, opposite each other. Almost simultaneously it is announced that Washington, D.C., has formally adopted a comprehensive plan for illuminating the streets of the entire city, and has begun to place orders for the equipment. The plan was submitted by the Illuminating Engineering Laboratory of the General Electric Co., and two distinctive characteristics are the classifying of the streets according to importance, and establishing the "architectural family" of lighting standards. The lumens per linear foot will range from a minimum of eight to 275, with provision for increased lighting intensities if found desirable in the future. Mazda lamps varying from 600 to 250 c.p., with ornamental arc light units for down-town use are to be utilised.

Inquest.—An inquest was held on December 19th at Croxdale (Co. Durham) upon the body of George Pollock, electric pump minder, who was killed at Croxdale Colliery on the previous day. Joseph Watson, a pity boy, said that deceased put his arm, holding a lamp, through the door of a switch-chamber, and sparks began to fly. Witness thought deceased must have touched the terminals with the lamp, and witness telephoned to the bank asking them to switch off the current. Joseph Richardson, wagonway man, said I.

found deceased lying on the floor of the pump room. His feet were near the switch cabinet. When he pulled the body clear there were no signs of life. Harold Thomas Anderson, electrician, stated that the switch chamber was in his charge and he kept the key; he was not aware that any other person possessed a key. The pressure was about 2,900 V alternating. Coroner Proud recorded a verdict of "Accidentally killed by electric current through a lamp he was holding coming into contact with the live terminals of electrical plant."

Local Societies.—BIRMINGHAM ELECTRIC CLUB.—At the annual meeting of the Birmingham Electric Club on December 19th, under the chairmanship of Mr. W. Shaw, it was stated that the club membership was 183, as compared with 171 last year, and there was a balance of £35. Mr. F. Unwin was elected president, and Mr. T. Birkett, vice-president.

THE WEST YORKSHIRE METALLURGICAL SOCIETY.—At a meeting in Huddersfield on January 6th, a discussion will take place on "The Value of some Workshop and Laboratory Tests."

The New Farming.—In a recent address on "Electricity, the Creator of Happy Farm Homes" (reproduced in the *N.E.L.A. Bulletin*), Mr. S. M. Kennedy, vice-president of the Southern California Edison Co., said:—"It is not so long ago that even in this country all of the work on the farm was done by hand labour, with some assistance from horses. The monotonous routine duties could not be shirked. The ploughing, sowing, reaping, wood cutting, milking, hauling water—all of these represent the hardest kind of manual labour. At the same time, the housewife did washing, ironing, sweeping, churning, sewing, and cooking with the crudest sort of devices. Hard work, long hours, and isolation from their fellows marked the life of the American farmer and his family. Research along certain lines indicated some few years ago that suicide was more prevalent among farmers than in any other occupation in America. The monotonous grind of life was considered responsible for this deplorable condition. The coming of electricity must undoubtedly change the farmer's mental and physical attitude.

"In California we have an unusually liberal use of electricity in rural territory on account of the necessity of pumping water for artificial irrigation. It is this field, pioneered by the gas engine, and later turned over to the electric motor, which furnishes enough revenue to the power companies to justify the building of long extensions. When the extension is made to serve a pumping plant, all of the other numerous uses of electricity follow as a matter of course. The most irksome work is now done automatically by the magic servant. Lighting, washing, ironing, cleaning, cooking, milking, separating, wood cutting, hay stacking, grain hoisting, feed grinding—all of these things are accomplished by the turn of a switch."

Scientific Illumination. — At a meeting of the Scientific and Technical Circle of the Institute of Journalists on December 18th, Sir Richard A. Gregory presiding, Mr. Leon Gaster traced the development of the Illuminating Engineering Movement during the past twenty years. In 1909 he was instrumental in founding the Illuminating Engineering Society, in London—the first body of the kind to be formed in Europe. Since that date, he said, an interest in all forms of lighting had sprung up in other countries, and it had become a subject of international interest. It was anticipated that provisions requiring adequate and suitable lighting would be embodied in the Factory Acts in the near future. The Illuminating Engineering Society was now embarking on a widespread scheme for promoting public appreciation of the benefits of good lighting; the daily and technical Press could render most valuable service in bringing home its importance to the public.

W/T Valve Transmitters.—The paper which Mr. G. Shearing, B.Sc., M.I.E.E., recently read before the Wireless Section of the Institution of Electrical Engineers describes the development of some of the valve telegraph transmitters employing rectified a.c. for naval purposes from December, 1918, onwards. The earlier work is briefly reviewed and general considerations of design for ship conditions are dealt with. The method of calculating the geometry of the rectifying valve electrodes and the power loss is described, as are also some of the types of transmitter circuits employed, also detail circuit improvements for satisfactory working. Arrangements of valves in series and the use of coupled circuits for drying-out wet aerial systems, and separate grid-excitation circuit arrangements, are dealt with. Experimental circuits for the reduction of harmonic interference, also the arrangements adopted for signalling by grid potential control, are discussed. Finally, the design of the transmitting valve electrodes is dealt with and valve rating is discussed, it being emphasised that the geometry of the valve has a higher degree of importance than the anode power rating. For the valve manufacturer it is essential to specify a given anode power for static bombardment of the valve, and acceptance tests, but this may not necessarily represent the safe anode power dissipation for oscillatory conditions. For the case of a valve the anode of which is to be bombarded to 30 kW during exhaustion, if we allow 60 per cent. as the minimum operating efficiency, the oscillatory rating of the valve for a factor of safety of 2 would correspond to a supply power of 37.5 kW and an aerial power of 22.5 kW. Efficiencies of the order of 60 to 70 per cent. are readily obtained in practice, but higher efficiencies obtained by increasing the grid negative potential may result in a considerable increase of harmonics. It has been usual to employ not more than three valves in parallel for aerial powers up to 60 kW, these valves being capable of handling a supply power of 90 kW, and, for still higher powers, arrangements of six valves in series-parallel (three valves in each bank with two banks in series) are being employed. This avoids excessive complexity of valve connections, and, in the event of the failure of a valve, there is usually a sufficient reserve of power to tide over the emergency; it also saves space, with improved operating efficiency. To meet these requirements the silica valve was developed during 1919-20 in three main sizes, namely, for supply powers of 5 kW, 9 kW, and 20 kW. More recently, single valves have been designed for supply powers of 30 kW and 60 kW at an anode supply of 12,000 volts. For supply powers up to 30 kW the valve seals and envelopes have been cooled by air ventilation, but for these or higher powers water cooling may be employed.

A Demonstration of Progress in Electric Lighting.—The Illuminating Engineering Society made an interesting departure on December 16th, 1924, in arranging for its meeting to be held at the E.L.M.A. Lighting Service Bureau. Mr. C. W. Sully, who presided, welcomed the members of the Society and expressed his pleasure at the attendance of a number of representatives of the gas industry. His short address dealt with recent progress in electric lamps, referring more particularly to the recently issued standard specification. By co-operation between lamp makers and users a simple and practical schedule, available with slight modifications for all forms of lamps, had been adopted, and by means of diagrams Mr. Sully illustrated the marked improvement that had taken place in "useful life."

An address was then delivered by Mr. W. E. Bush, who discussed in some detail methods of approaching consumers with regard to the benefits of good lighting, and illustrated his remarks with numerous demonstrations. A feature was the elaborate arrangements of types of lighting units, spaced in various ways, whereby the effects of different spacing arrangements could be demonstrated, &c., and varied colour-effects were also shown. One interesting novelty was the small camera shown by Dr. Rosenthal, specially designed for taking photographs by artificial light. By the aid of a lens with a very large aperture the exposure for illumination of five foot-candles can be reduced to two seconds, which enables photographs with figures of people to be obtained.

After light refreshments Mr. L. E. Buckell gave a short demonstration of some of the latest types of lighting units. The new colour-sprayed lamps with diffusing bulbs were shown and, with the aid of pictorial posters, methods of securing even illumination for billboard-lighting were discussed. Other units shown included the Holophane two-way and four-way street-lighting units, and there were also some promising examples of the latest devices adopted for illuminated letter-signs.

After the interval there was a good discussion, in which Mr. L. Gaster, Mr. J. G. Clark, Mr. J. Eck, Mr. Raffé, Dr. Rosenthal, Mr. S. Brook, Mr. J. S. Dow, Mr. Ruthven Murray, Mr. A. Cunnington, and Mr. P. J. Waldram took part.

Mr. L. Gaster, in voicing the thanks of the Society for the invitation to hold a meeting on the premises of the Bureau, pointed out many ways in which the E.L.M.A. Lighting Service Bureau and the Society could work together, and summarised some of the plans involved in the Society's programme for promoting better public appreciation of the benefits of good illumination. Later on Mr. P. J. Waldram mentioned that the Society contemplated arranging informal meetings and visits to interesting installations in between its usual monthly meetings. Mr. J. G. Clark, a representative of gas lighting, expressed his appreciation of the opportunity provided of seeing what was being done in connection with electric lighting. There was some good-humoured comment on some of the demonstrations. Mr. Cunnington, as one concerned with lighting on a large scale on the Southern Railway, pointed out the need for justifying economically illumination much in advance of that now being adopted, whilst Mr. Dow suggested a modification in one of the diagrams illustrating the effect of glare on the eye, and emphasised the need for tests, showing in a simple way the evils of glare, the importance of light coming from the right direction, &c., matters which were quite as important as high illumination.

There was a good attendance, and it was announced that at the next meeting of the Society, on January 27th, Mr. J. W. T. Walsh would open a discussion on "The Preparation of Lighting Specifications; Theoretical Considerations and Testing of Results."

Italy's Electrical Development.—No branch of Italian industry showed more marked improvement during the past year than that of electricity supply. During the fiscal year 1923-24 the total consumption was estimated at 5,800 million kWh, as compared with 5,401 millions in 1922-23, and 4,302 millions in 1921-22. By the use of electric power, Italy is now saving annually about 1,500 million lire which otherwise would be paid for imported coal. In 1924 there were 360 undertakings, with a capacity of 1,600,000 h.p., a share capital exceeding 2,250 million lire and bond issues totalling 14,000,000 lire. The total investment in hydro-electric undertakings is esti-

mated at over 3,000,000,000 lire. The Edison Company of Milan increased its capital from 180,000,000 to 450,000,000 lire. In the current year some twenty-four additional stations will be finished with a combined annual output of 2,209,000,000 kWh. A further fifty-six plants, estimated to generate 3,908,500,000 kWh per annum, have been arranged for. In Sardinia, the Tirso dam, the first important hydro-electric installation in the island, was inaugurated. The enterprise serves to irrigate about 75,000 acres of land in the Oristano plain, and furnishes 50,000,000 kWh of electric power per annum. The Tirso is the first of a series of similar projects, including the Coghinas, Flumendosa and Terno Rivers. With the completion of new hydraulic plants under construction in the Silla mountains, Italy will soon be connected from the Alps to Sicily by a distributing system to which most of the power stations are able to furnish current—from the Adamello Company in the Alps and the Terni Company in Central Italy, to the Sila in Calabria and the Generale Elettrica in Sicily. Improvement was shown both in exports and imports of electrical machinery, apparatus and supplies. The largest imports, more than a quarter of the total, were of electric lamps, Holland being the chief source of supply. Compared with imports during 1923 there was a notable advance in the number and value of electrical generators and motors, but the remarkable figures of 1922 were not equalled. The domestic electrical manufacturing industry continued to expand encouragingly while overseas trade showed further development. It may be added that the value of generators and motors exported from Italy exceeded the value of these articles brought into the country. The exports of generators and motors were chiefly to Latin America, the Mediterranean, Asiatic and other non-industrial regions. The foreign market for electrical machinery in general extended over a wider area compared with the previous two years. Radio activity continued to suffer from Government restrictions, licences being still somewhat difficult to obtain.—*Reuter's Trade Service* (Rome).

The Industrial Welfare Society.—In order to stimulate interest in the subject of welfare work in industry, the Society has recently published a symposium of views on the subject contributed to by a number of people prominent in public affairs and industry. All of these agree as to the benefits of welfare work to the workers in an industry, to the industry itself, and through them to the nation as a whole. The Society has done a great deal of useful work in an unobtrusive manner, and its unobtrusiveness has probably militated against its financial stability. It is hoped that sufficient funds will be forthcoming to enable the Society to wipe out the deficit under which it still labours.

Fatality.—The *Daily Mail* reports that George Ilett, Ramsey, Huntingdon, was killed recently, his skull being fractured owing to the bursting of an electric generator in his shop.

Institution Notes.

Institution of Electrical Engineers.—THE FARADAY LECTURE.—The first Faraday lecture under the auspices of the Institution of Electrical Engineers, in memory of Michael Faraday, was delivered on December 17th, at Newcastle-on-Tyne, by Dr. G. W. O. Howe, D.Sc., M.I.E.E., James Watt Professor of Electrical Engineering at the University of Glasgow. Sir Theodore Morison presided, and expressed his pleasure at the selection by the Council of Prof. Howe to give the first lecture. He was one of the most distinguished students of the electrical engineering department of Armstrong College. The object of the founding of the lectureship was to give an opportunity for discussion and wider publicity of the problems of large-scale engineering.

The title of the lecture was "World-wide Radio-Telegraphy." The lecturer traced the growth of the subject from its commencement to the present day. The lecture will be delivered again, before the North-Western Centre, on Tuesday next.

Radio Society of Great Britain.—An informal meeting of the Society will be held at the Institution of Electrical Engineers at 6 p.m. on January 14th, when Mr. Stanley Ward will talk about "Short-Wave Reception." An ordinary meeting of the Radio Society will be held at the Institution at 6 p.m. on January 21st, when Sir Oliver Lodge, D.Sc., LL.D., F.R.S., the newly-elected president of the Society, will deliver an address entitled "Matter and Radiation."

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

New Year Honours.—Hearty congratulations to Mr. BENJAMIN LONGBOTTOM, chairman of the British Electrical and Allied Manufacturers' Association, also to Mr. E. W. PETTER, president of the British Engineers' Association, and to Col. J. W. PRINGLE, Chief Inspecting Officer of Railways (Ministry of Transport), upon the honour of knighthood conferred upon them in the New Year List, which appears at the moment of going to press. Upon SIR ERNEST RUTHERFORD, F.R.S., there has been conferred the high distinction of "Order of Merit," a recognition which will receive the most cordial approval of all scientific men.

We gave in our last issue an account of the dinner and presentation given to Mr. F. STACEY HOOKER on resigning the sales managership of the Sterling Telephone & Electric Co., Ltd. Mr. Hooker, who had been associated with that company for 23 years, has joined Messrs. C. A. Vandervell & Co., Ltd., of Acton, and has a seat on the board. He is remembered as one of the earliest pioneers of the wireless business

Adolphus Tear] **Mr. F. Stacey Hooker.** [*Bayswater.*

in this country, and has travelled in all parts of the world. He will take a large and responsible part in the management of the Acton company, which has recently introduced a loud speaker and batteries for wireless work.

Mr. WILLIAM BLOGG, for many years manager of the Sterling Telephone & Electric Co.'s branches at various periods at Newcastle-on-Tyne, Cardiff, and Manchester, and who for the past 10 months has been making an extensive tour on behalf of the company through Canada, Australia, New Zealand, and South Africa, has recently returned home. Mr. Blogg now takes up his position at the head offices, 210, Tottenham Court Road, London, W.1, as sales manager of the company's entire organisation.

Mr. P. W. TUCKER recently resigned from the service of the Great Yarmouth Corporation Electricity Department, in order to take up a position on the editorial staff of the ELECTRICAL REVIEW.

A *Reuter* dispatch from Winnipeg states that Mr. F. M. BLACK, the State Treasurer, has resigned from the Government in order to take up the post of vice-president of the Winnipeg Electric Co., and to take charge of its finances.

The *Morning Post* states that the Council of the Physical Society of London has unanimously decided to award the second Duddell Memorial Medal to PROF. C. VERNON BOYS, F.R.S.

The Battersea Borough Council Electricity Undertaking Committee has appointed Mr. F. H. HOWELL, of Tooting, S.W., to be commercial assistant engineer at a salary of approximately £500 per annum (National Joint Board Schedule, Grade 4, Class F). One hundred and forty-one applications were received for the appointment, and seven gentlemen were interviewed.

Mr. C. C. KIRBY, of the Shropshire, Worcestershire, and Staffordshire Electric Power Co., has been appointed assistant engineer with the West Gloucestershire Power Co.

On December 11th Mr. OWEN D. YOUNG, chairman of the board of directors of the General Electric Co., Schenectady, U.S.A., was honoured by a banquet tendered by a thousand leaders in different walks of life at the Waldorf-Astoria Hotel, New York City. The *Electrical World* states that the banquet was a brilliant affair, and the main ballroom of the hotel was draped in Allied colours from top to bottom. President Coolidge sent a message, and others were received from the Premiers of Britain, France, Italy, and Belgium, and many others. Men prominent in American electrical industry were present in large numbers, but the tribute had nothing to do with Mr. Young's connection with that industry. Its purpose was to signalise "the great success with which, in the first instance, he had co-operated with General C. G. Dawes and H. M. Robinson to frame the reparations agreement known as the Dawes plan and, in the second instance, had performed the duties of administrator of this plan until it was well launched and could be left to the guidance of another."

The Edison Medal Committee of the American Institute of Electrical Engineers has awarded the Edison Medal for 1924 to Mr. J. W. HOWELL, of Newark, N.J., for his contributions toward the development of the incandescent lamp.

MR. R. MARTILL-WILSON, A.M.I.E.E., who recently resigned his post with the Ebbw Vale Steel, Iron & Coal Co., Ltd., with whom he had been employed for upwards of seven years, has joined the engineering staff of the Consett Iron Co., Ltd., Co. Durham.

MR. W. H. BROWN, who has been in the service of the Metropolitan Railway Company for 52 years, retired from the secretaryship on December 31st. He is succeeded by Mr. H. S. Stewart, assistant to the general manager.

Obituary.—SIR A. M. J. OGILVIE.—We regret to record the death, which occurred on December 26th at Woking, of Colonel Sir Andrew M. J. Ogilvie, K.B.E., C.B. Sir Andrew was born in 1858, so was 66 years of age. He was educated at University College, London, and was private secretary to successive Postmasters-General between 1891 and 1899. He became Assistant Secretary to the General Post Office in 1903; was Third Secretary from 1911-1914, and Joint Second Secretary from 1914-1919. He was a British delegate to the International Telegraph Conference at Lisbon in 1908. He was a colonel (retired) in the R.E. (T.F.), and from 1913 to 1919 was Director of Army Signals (Home Defence). Sir Andrew had been an Associate of the Institution of the Electrical Engineers since 1904, and he was a member of the Council. The funeral took place on Tuesday last at Brookwood Cemetery.

Will.—MR. E. PRIOR, electrical engineer, of Burgess Hill, left £34,465 gross and £9,607 net personalty.

New Companies Registered.

Hackett & Co., Ltd. (202,602).—Private company. Registered December 22nd. Capital, £2,000 in £1 shares. To carry on the business of electricians, mechanical engineers, suppliers of electricity for light, heat, motive power or otherwise, manufacturers of and dealers in wireless apparatus and wireless, electrical, magnetic and galvanic instruments, &c. The first directors are:—Mrs. E. A. Hackett, 21, Crosby Road, Birkdale; R. S. Gray, Austin House, Chapel Street, Hull. Qualification, £1. Solicitor: G. B. Edwards, 30, Hoghton Street, Southport.

Sexton-Barnes, Ltd. (202,477).—Private company. Registered December 17th. Capital, £200 in 1s. shares. To carry on the business of electrical, motor, cycle and radio engineers, &c. The first directors are:—W. Wrentmore, 31, Great St. Andrew's Street, W.C.2, engineer; R. J. Boning, 104, Alexandra Road, N.W.8, accountant. Qualification, 1 share. Registered office: 61, Borough Road, S.E.

Radiolicity, Ltd. (202,672).—Private company. Registered December 24th. Capital, £1,000 in 950 6 per cent. cumulative preference shares of £1 and 1,000 ordinary of 1s. To carry on the business of engineers, advisers, experts, consultants and contractors in connection with wireless telephony and telegraphy, &c. The first directors are:—J. Blaiberg, Regency House, Warwick Street, W.1, estate manager; Mrs. V. Erdman, 65, Fitzjohns Avenue, Hampstead; S. M. Miles, 28, Devonshire Road, Harrow, secretary. Qualification, 1 ordinary share. Secretary, S. M. Miles. Registered office: 1, Regency House, Warwick Street, W.1.

Radiovox, Ltd. (202,691). — Private company. Registered December 27th. Capital, £100 in £1 shares. To carry on the business of wireless apparatus manufacturers and dealers, electrical and mechanical engineers, printers and publicity agents, &c. The first directors are:—C. Millar, 707, Aylestone Road, Leicester; H. R. Hodgson, 2a, Trevanion Road, West Kensington, W.14. Qualification, one share. Secretary: A. P. Hartley. Registered office: 57-58, Chancery Lane, W.C.2.

Darco, Ltd. (202,679). — Private company. Registered December 27th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers and suppliers of and dealers in apparatus for wireless telegraphy and telephony, and other electrical, magnetic and acoustic appliances and apparatus, proprietors and publishers of newspapers, books and periodicals, &c. The permanent directors are:—L. W. Darley (chairman), 46, St. Albans Road, Watford; R. D. Tyers (managing director), 30, Mildred Avenue, Watford. Remuneration as fixed by the company.

Dussek Bitumen Co., Ltd. (202,709).—Private company. Registered December 29th. Capital, £10,000 in £1 shares. To adopt an agreement with A. E. H. Dussek, to carry on the business formerly carried on by him, and that of manufacturers and refiners of asphalt, bitumen, pitch, vegetable and mineral oils, paints, greases, fats, lubricants and illuminants, insulating material (electric or otherwise) and building materials, distillers of tar and other products, rectifiers of spirit of any description, makers and sellers of inks, dyes, disinfectants, wax or other products, waterproofers, manufacturers of or dealers in preservatives for stone, wood, iron, brick or other substances, &c. The first directors are:—A. E. H. Dussek, 44, Park Avenue, Bromley, Kent, manufacturer (permanent chairman and managing director); A. J. Dussek, 44, Park Avenue, Bromley, Kent, manufacturer. Qualification, £10. Remuneration of A. E. H. Dussek as managing director, £2,000 per annum, and 10 per cent. of the profits before paying any dividends. Solicitors: Wrensted, Hind and Roberts, 63, Queen Victoria Street, E.C.4. Registered office: Empress Wharf, Sherman Street, Bromley-by-Bow, E.3.

Official Returns of Electrical Companies.

Eastern Telegraph Co., Ltd. (6,338). — Return dated July 8th, 1924. Capital, £7,000,000 in £5,000,000 ordinary stock and £2,000,000 preference stock. All stock taken up and fully paid. Mortgages and charges, £2,000,000.

White, Jacoby & Co., Ltd. (52,494).—Return dated September 18th, 1924. Capital, £7,500 in £1 shares. 5,794 shares taken up. £3,437 paid. £2,357 considered as paid. Mortgages and charges, £1,500.

Electric Reduction Co., Ltd. (54,724). — Return dated November 24th, 1924. Capital, £50,000 in 16,200 preference and 33,800 ordinary shares of £1 each. 16,200 preference and 28,800 ordinary shares taken up. £18,000 paid. £27,000 considered as paid. Mortgages and charges, £25,000.

Walsall Electrical Co., Ltd. (37,696).—Return dated October 28th, 1924. Capital, £20,620 in £1 shares. 12,000 shares taken up. £10,000 paid. £2,000 considered as paid. Mortgages and charges, nil.

Holophane, Ltd. (110,941). — Return dated November 14th, 1924. Capital, £105,000 in 100,000 preference shares of £1 each and 100,000 ordinary shares of 1s. each. 60,757 preference and 100,000 ordinary shares taken up. £15,207 paid. £50,550 considered as paid. Mortgages and charges, nil.

Ewart Lawson, Ltd. — Debenture dated December 3rd, 1924, to secure £150 charged on the company's property, present and future, including uncalled capital. Holder: T. Leary, 2, Edward Street, Darfield, near Barnsley.

Llangollen and District Electric Light & Power Co., Ltd.—Two debentures dated December 4th, 1924, to secure £500 each and, as collateral security thereto, a mortgage of even date, charged (by debentures on the company's undertaking and property, present and future, and (by mortgage) on the leasehold portion of Dee Mill, Llangollen, with powers therein to install dynamos and generators, also water power for driving the plant and machinery used by the company for the production of electric energy, and also power to lay cables. Holders: E. R. Parry, 39, Castle Street, Llangollen, and T. L. Jones, Penybryn, Llangollen.

Ackroyd & Best, Ltd.—Issue on November 25th, 1924, of £50 debentures, part of a series already registered.

Allerton Electrical Supply, Ltd.—Mortgage dated December 16th, 1924, to secure £1,400, charged on 82, Allerton Road, Wavertree, Liverpool. Holders: R. K. Lockett and G. G. Smith, 21, Water Street, Liverpool.

Projector Publicity Co., Ltd.—H. Rainsbury, of 65/66, Basinghall Street, E.C.2, ceased to act as receiver on July 18th, 1924. (Notice filed December 17th.)

Norwood Wholesale Fittings Supply Co., Ltd.—A. J. P. Coleman, of 174, High Street, Acton, W.3, ceased to act as receiver on December 12th, 1924.

Wireless Experts, Ltd. — Satisfaction to the extent of £500 in November, 1924, of debenture dated December 10th, 1923, securing £1,000.

General Electro-Motives, Ltd.—Particulars filed of £2,000 debentures authorised December 15th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,300.

Waltham Radio, Ltd.—Particulars filed of £500 debentures authorised December 16th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

C. F. Casella & Co., Ltd. (106,869).—Return dated October 1st, 1924. Capital, £17,000 in 15,000 ordinary and 2,000 preference shares of £1 each. 12,204 ordinary and 2,000 preference shares taken up. £3,504 paid. £10,700 considered as paid. Mortgages and charges, £1,800.

Kalgoorlie Electric Power & Lighting Corporation, Ltd. (91,219).—Return dated July 4th (filed November 4th), 1924. Capital, £50,000 in 5 preference shares of £1 each and 100,000 ordinary shares of 10s. each. 100,000 ordinary shares taken up. 10s. per share called up on 7 shares, £3 10s. paid. £49,996 10s. considered as paid on the remainder. Mortgages and charges, £128,303.

Western Electric Distributing Corporation, Ltd. (79,057).—Return dated October 30th, 1924. Capital, £100,000 in 50,000 cumulative preference and 50,000 ordinary shares of £1 each. All shares taken up. £1 per share called up on 50,000 preference and 31,538 ordinary and 2s. 6d. per share on 18,462 ordinary. £83,591 7s. 6d. paid (including £65 12s. 6d. paid in advance of calls, but excluding £320 calls unpaid). Mortgages and charges, nil.

Barnsley and District Traction Co., Ltd. (72,962).—Return dated June 11th (filed September 27th), 1924. Capital, £125,000 in 50,000 preference and 75,000 ordinary shares of £1 each. 22,000 preference and 60,105 ordinary shares taken up. £62,070 paid on the preference and 40,070 ordinary shares. £20,035 considered as paid on the remainder. Mortgages and charges, £19,928 4½ per cent. debenture and £29,000 second debenture stock (issued to bankers as collateral security).

Electric Supply Co. of Victoria, Ltd. (66,059).—Return dated November 27th, 1924. Capital, £325,000 in 175,000 preference and 150,000 ordinary shares of £1 each. 175,000 preference and 125,000 ordinary shares taken up. £50,007 paid. £249,993 considered as paid. Mortgages and charges, £81,578.

City Notes.

Johnson and Phillips, Ltd.

The adjourned meeting of debenture stock-holders was resumed on December 23rd. Mr. Leslie Wates, who presided, stated that amended terms for the treatment of the existing 8 per cent. debentures had been agreed upon between a stockholders' committee and the board. He, however, formally moved the original resolution, and Mr. Taylor, one of the members of the committee, moved an amendment which provided that the rate of interest should be reduced to 6 per cent., as from July 1st next.

A stockholder said that she considered that any dissenting stockholder should receive the par value of the debentures, but the amendment was carried with three dissentients. The amended resolution was then carried. At a subsequent meeting it was agreed that if the company wished to redeem the stock, apart from the annual drawings, it should do so at the rate of £102 per cent.

Montreal Tramways & Power Co., Ltd.

The *Financial Times* states that the company's report for the year ended November 30th last shows a total loss of $13,495,662. The bulk of this ($11,038,200) was incurred in the sale of securities of the Canadian Light & Power Co., and there were other losses in connection with the transfer of shares, exchange, &c. The operating loss for the year was $77,647. The report states that the necessity arising in the past of the company conducting its financial operations by means of short-term securities has resulted in extremely heavy losses of discount and legal charges, amounting to $658,520; in addition, there are litigation charges of $32,195. "As your company has no reserves

upon which to call to replace these losses and charges, they have resulted in an impairment of capital." On March 1st, 1924, the short-term bonds of the company in the amount of $7,300,000 became due. For the purpose of refunding this amount and to provide for further requirements of the company, an issue of five-year six per cent. collateral trust gold bonds of the aggregate par value of $8,000,000 was created and sold by the company. The company is offering $3,266,600 first and refunding mortgage five per cent. gold bonds (now first mortgage), dated July 1st, 1911, and due July 1st, 1941, at 95. The bonds are redeemable at 105.

Adelaide Electric Supply Co., Ltd.

The net profit for the year ended August 31st, 1924, was £228,088, upon gross earnings of £530,465, and after providing for debenture service there was a balance of £150,877, to which was added £38,186 brought forward, making £189,063. A dividend of 6 per cent. (making 12 per cent. for the year) is paid on the ordinary shares, and a balance of £47,186 is carried forward.

French Companies.

Shareholders of the *Compagnie de la Maison Breguet* have approved of the proposal to increase the share capital by 4,000,000 fr. to 12,000,000 fr., with the right to make a further increase to 16,000,000 fr. The new capital is needed to enable the company to execute the large orders on hand.

The report of the *Compagnie Générale d'Electricité*, whose financial operations for 1923-24 were recently recorded, states that on the whole the results yielded by the company's different industrial establishments as well as by its branches and participations showed notable progress over the preceding year; their activity was accentuated, orders having become more numerous and more important and the sale prices less keenly contested. The turnover everywhere increased under the double influence of the activity of the market and the fall in the franc. At the recent annual meeting it was stated that the new financial year was expected to furnish better results than those obtained in 1923-24, and that therefore it was possible to hope that the dividend at 70 fr. per share would be maintained despite the increased capital.

German Electrical Companies.

The *Bergmann Electricity Works Co.*, of Berlin, has converted its capital to a basis of 33,000,000 gold marks, as compared with 47.75 millions of marks in 1913. At the recent meeting it was mentioned that business had developed satisfactorily, and the turnover had again approximately reached the pre-war level.

The *Saxony Light and Power Works Co.*, of Niedersedlitz, reporting at the recent annual meeting, stated that an improvement has recently taken place in the number of orders received, and a lasting betterment is expected from the circumstance that the electricity supply works are scarcely able to satisfy the demands for new connections.

The *Poege Electricity Co.*, of Chemnitz, states that the costs of production in 1923-24 were far above the level of those of ten years ago, and a large part in this matter was played by rates and taxes, but no compensation was afforded by the sale prices owing to the sales policy of the big firms. It is added that a slight improvement in business has taken place recently.

The directors of the *A.E.G.*, in introducing for the approval of the shareholders the gold mark balance sheet for the year ended with September 30th, 1924, have reduced the paper mark capital to 121,000,000 gold marks in ordinary shares, 17,500,000 marks in "A" preference shares, and 17,500,000 marks in "B" preference shares, as well as certificates for 1,250,000 marks applying to the "B" preference shares, while the reserve fund stands at 16,000,000 gold marks. The transformation brings the total capital approximately to that of 135,000,000 marks which prevailed in the pre-war period. The net profits for the year ended with last September are not yet available, but it is announced that the directors propose to pay a dividend at the rate of 5 per cent. on the ordinary and "B" preference shares, and 6 per cent. on the "A" shares.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Serck Radiators, Ltd.—120,000 shares of £1 each, fully paid, Nos. 1 to 120,000.

Siemens Brothers & Co.—45,000 new ten per cent. cumulative preference shares of £1 each, fully paid, Nos. 315,001 to 360,000, ranking for dividend from January 1st, 1925.

The undermentioned have been ordered to be officially quoted:—

Ayrshire Electricity Board.—Scrip, fully and partly paid, for £750,000 Ayrshire (Local Authorities) Electricity 4½ per cent. redeemable stock, 1945-55.

British Insulated & Helsby Cables.—£184,500 five per cent. mortgage debenture stock.

Traction and Power Securities Co.—£300,000 four-and-half per cent. debenture stock.

Application has been made to allow the following to be officially quoted:—

Barcelona Traction, Light, and Power Co.—£2,800,000 consolidated 6½ per cent. prior lien bonds.

Quebec Light, Heat, Railway and Power Co., Ltd.—A dividend of 4 per cent. has been declared on the common shares for the year ended December 31st, and one of 1¾ per cent. on the 7 per cent. cumulative preferred shares for the quarter ended December 31st.

Major & Co., Ltd.—The net profit for 15 months ended March 31st, 1924, was £35,144, and to this is added £2,443 brought forward. After the payment of a final dividend of 5½ per cent. on the preferred ordinary shares, making 8¾ per cent. for the year, £9,650 is to be carried forward. No dividend has been declared on the ordinary shares.

Canary Isles.—The report for the year ended September 30th last of the Société des Tramways Electriques de Teneriffe et Extensions shows a profit of 89,191 fr., as compared with only 17,556 fr. in the preceding 12 months.

Cork Electric Tramways and Lighting Co., Ltd.—A final dividend has been declared on the 5 per cent. cumulative preference shares for the year ended December 31st, 1924, less tax.

Marconi International Marine Communication Co., Ltd.—The directors have declared an interim dividend of 5 per cent., less tax, on account of the year ended December 31st, 1924.

Marconi's Wireless Telegraph Co., Ltd.—The full dividend has been declared on the 7 per cent. cumulative participating preference shares for the past year.

Siemens Bros. & Co., Ltd.—Half-yearly dividend on the 10 per cent. cumulative preference shares, payable January 15th.

Mackay Companies.—Quarterly dividend of 1¾ per cent. on the common stock.

Stocks and Shares.

TUESDAY EVENING.

THE year 1924 will deserve to be long remembered by shareholders in the electricity supply companies as one of the kindest to which they have been treated since they acquired an interest in this industry. It was thought at the end of 1923 that the electricity supply business might then be standing at the apex of its prosperity, and that, while the results of 1924 might possibly equal those of the 1923 figures, which were extraordinarily good, little more could be expected in the shape of increased values of shares, and a still brighter outlook for the future. As things have turned out, fortune has smiled yet more indulgently than she did in the previous twelve months, and it is exceedingly pleasant to be able to tabulate the expansion which has taken place in the capital value of shareholders' interests.

The uncertainty regarding the outcome of the General Election in November had, for a time, a sobering effect upon the buoyancy of the market, but when the issue of the poll became known, confidence at once revived, and prices with it. Not that prices had gone back, however, to any extent beforehand. The end of October, 1924, was expected to be a very critical time for the London companies, in that the two London Bills which, when passed, will establish the industry upon a more stable foundation than it has enjoyed before, were known to be the subject of dissension in the Labour Cabinet. With the Unionists in power, the prospect of both Bills passing the House of Commons—they have already gone through the House of Lords—is greatly improved, and, although there will be some little opposition when they come before Parliament in the early spring, the Government majority is sufficiently powerful to enable a clear passage for these two important measures.

In the annexed price-lists, we give the present quotations compared with those of a year ago, and add the highest and lowest reached during the twelve months that end on Wednesday in this week. It will be observed that to-day's prices stand almost at the best levels touched during the period.

ELECTRICITY SUPPLY SHARES.

	Dec., 1923.	H.	L.	Now.	Rise or fall.
Brompton	2⅛	45/-	35/9	1⅝	— ⅛
Charing Cross...	14⅜	58/-	2	2⅛	—12/-
Chelsea	37/-	39/6	33/6	37/6	+6d.
City of London	2⅛	50/-	43/-	47/6	+ ⅜
County	40/-	52/-	38/9	52/6	+ ⅝
Kensington	10⅜	11	9½	10⅞	+ ⅜
London	4⅛	34/-	29/-	33/6	+ ⅛
Metropolitan	33/9	38/-	30/6	1⅝	+ ⅛
St. James'	11⅜	13⅜	11⅛	12⅜	+1⅛
South London	1⅛	46/9	36/9	2⅛	+ ⅛
Westminster	10⅛	11⅛	9⅜	11	+ ⅛

The falls are only apparent and not real, being caused by deductions on account of "rights."

Several of the provincial and suburban companies' shares have participated in the strength shown by this market. The next batch of dividend announcements is awaited with pleasurable anticipation, for the rates are expected to show improvements upon the banner results achieved in 1923. A year hence, the table is likely to present a different appear-

ance, though in what manner, it is impossible to say until further information is available as to the way in which the companies are likely to treat their reserves, after the Bills have passed.

In the group of cable and wireless stocks, it is a little surprising to find that Marconis have come back sharply. The resignation of Mr. Godfrey Isaacs from the board of the company, and the appointment to his position of Mr. Kellaway have aroused uneasiness in regard to the manner in which the next balance-sheet will be presented, for there may be a drastic writing-down of assets under the new *régime*, and timid shareholders have been selling in advance of the event. Cable stocks are better on the year, a good impression having been produced by the showing made by the Western Telegraph Company. Trade having been quiet, it had been rather expected that the cable companies might have felt the effect of this want of elasticity in international business, but the Western Company's figures announced increased profit, and this leads to the natural supposition that the other members of the Eastern group will do equally well. A striking rise has occurred in Radio shares, the buying having come largely from the United States, where the progress of the company is more intimately known, of course, than is possible on this side. The West India and Panama Company has come to an inglorious end, and, although not actually extinct, is likely to become so shortly. This is the table of comparisons:—

TELEGRAPHS, &c.

Stock or share.	Dec., 1923.	H.	L.	Now.	Rise or fall.
Anglo-American Pref.	103½	106	101	104½	+1
Eastern Extension	16⅝	17½	15⅝	17	+⅜
Eastern Telegraph	164	176	155	172½	+8½
Globe Ord.	17	18⅜	16⅜	17½	+½
Great Northern	28	30½	28½	29⅞	+1⅜
Indo-European	32½	34	30	32½	—
Marconi	2⅛	2⅜	1⅞	1⅞	-⅛
United River Plate	6⅝	7⅜	6⅛	6¾	+⅛
Western Telegraph	15⅝	17½	15⅝	17	+1⅜

The Underground Railways did exceedingly well by reason of the Exhibition at Wembley, and Metropolitan stock reflects, in its substantial rise, the satisfaction felt with the volume of traffic handled during the rush season. The terms are at last announced upon which the East London Railway is to be taken over. The various railway and transport strikes had little effect upon Underground Railway prices, and, except in Metropolitans, it will be noticed that the range of difference between highest and lowest during the past year was not remarkable. We take six representative examples:

RAILWAY STOCKS AND SHARES.

Stock or share.	Dec., 1923.	H.	L.	Now.	Rise or fall.
Central London Ord.	73	74	66½	74	+1
Metropolitan	72	84½	71½	83	+11
District	54½	67½	48⅝	66	+1½
Underground Ord.	2/6	3/6	2/6	3/-	+½
" "A"	8/-	9/0	7/-	9/6	+1/6
" Inc.	100	104	90⅝	100	—

Manufacturing companies have done well, those in the cable group making, as usual, the best display. These undertakings continue to progress, and ordinary trade conditions appear to make little difference to their expanding of business. With the Unionists in power, the Safeguarding of Industries Act is likely to prove more effective than it was under the late Administration, and the efforts that are being made to foster British trade have helped to increase confidence in the outlook for trading concerns. These are some of the comparisons for the year:—

MANUFACTURING.

Share.	Dec., 1923.	H.	L.	Now.	Rise.
Babcock	2½	2½	2⅛	2⅜	⅛
British Aluminium	18/9	29/6	18/9	29/3	10/6
Callenders	2⅜	3	46/-	2⅝	⅛
General Electric	19/9	22/3	17/-	21/6	1/9
Henleys	48/9	3	2⅛	2½	⅜
India Rubber	⅛	1	12/-	17/6	5/8

The foreign groups show mixed changes. Mexicans are again disappointing. The various movements that are being made in the direction of re-establishing order in Mexico have not been entirely successful. The raising of a loan by the country failed to come to a material head. British Columbia Electric Railway stocks have advanced, in consequence of the company's increasing prosperity.

Money has been easy throughout the year, and the Bank Rate remains at 4 per cent., at which it was fixed 18 months ago. Money has poured into the Stock Exchange markets to an extent of which borrowers have taken full advantage. Had trade been good, a great deal of this capital would have been absorbed by industrial requirements, but in the circumstances, it had to go into Stock Exchange securities for lack of more remunerative use. This consideration has its effect in producing on the year such a favourable set of price-lists as we are able to publish to-day. From the Stock Exchange point of view, the New Year opens favourably. There is a lot of business afoot, and plenty of money available, not only for investment, but for speculation as well. Whatever may happen in the future, the present indications point to a continuance of improving Stock Exchange prices, with the concomitant feeling that there is a stronger basis than that of mere convention for wishing one's readers a Prosperous New Year.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1923.	Price Dec. 31, 1924.	Rise or fall.	Yield p.c.
Brompton Ordinary	1	12	10	1⅝	—	*£6 6
Charing Cross Ordinary	1	14	14½	2⅝	—	6 7
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 3
Chelsea	1	10	12	37/6	—	6 6
City of London	1	15	15	47/6	—	6 6
do. do. 6 % Pref.	1	6	6	23/6	—	5 2
County of London	1	10	15	52/6	—	5 14
do. do. 6 % Pref.	1	6	6	23/6	—	5 2
Edmundson's Ordinary	1	7	7	22/-	—	—
do. 7 % Pref.	1	6	6	22/6	—	6 4
Kensington Ordinary	5	12	14	10⅞	—	6 10
London Electric	1	10	10	33/6	—	5 19
do. do. 5 % Pref.	5	5	5	5½	—	5 4
Metropolitan	1	8½	10	1⅞	—	5 6
do. 4½ % Pref.	1	4½	4½	17/6xd	—	5 2
Newcastle-on-Tyne Ordinary	1	9½	6	22/6	—	5 6
do. 5 % Pref.	1	5	5	18/9	—	5 6
do. 7 % Pref.	1	7	7	25/-	—	5 12
Notting Hill 6 % Pref.	10	6	6	9½xd	—	6 4
North Met. Elec. 6 % Pref.	1	6	6	1⅛	—	5 6
Urban Ordinary	1	—	4	19/3	—	4 4
do 6 % Pref.	1	5	6	19/6	—	6 3
St. James' and Pall Mall	5	14½	17½	12⅝	—	6 18
South London	1	11	15	9⅛	—	6 13
South Metropolitan Pref.	—	7	7	1⅛	—	6 13
Westminster Ordinary	5	12	15	11	—	6 16
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	19/6	+3d.	7 13

HOME RAILS.

Central London Ord.	Assented Stock	4	4	74	+1	5 8
Metropolitan	"	3½	4	83	+ ½	4 16
do. District	"	3	3½	56	+ ½	6 5
Underground Electric Ordinary	10	Nil	Nil	3½	—	Nil
do. do. "A"	1	Nil	Nil	9/8	—	Nil
do. do. Income Bonds	5	5	5	100	—	*5 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	104½	— ½	5 14
do. Def.	"	1½	1½	24½	—	6 2
Chili Telephone	5	6	6	5⅝	+ ⅛	*5 5
Cuba Sub. Ord.	10	7	7	7	—	10 0
Eastern Extension	10	10	10	17	—	*5 17
Eastern Tel. Ord.	Stock	10	10	172½	+2½	*5 18
Globe Tel. and T. Ord.	10	10	10	17½	—	*5 14
do. do. Pref.	10	6	6	11⅛	—	5 7
Great Northern Tel.	10	24	23	29½	— ½	7 9
Indo-European	25	7	7	32½	—	*5 6
Marconi	1	15	10	1⅞	-⅛	6 8
Oriental Telephone Ord.	1	12	12	1⅝	—	*5 8
United R. Plate Tel.	5	8	8	6½	—	*5 15
Western Telegraph	10	10	10	17xd	—	5 17

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	12½	5½	8⅞xd	+ ⅛	8 13
do. do. 2nd Pref.	5	5½	5	2¾xd	— ⅛	10 8
do. do. 5% Deb.	Stock	5	5	73½	-1	6 15
British Electric Traction Ord.	"	5	5	99½	—	5 0
do. do 6% Pref.	"	6	6	106½	—	5 12
Brazil Traction	100	4	4	58	+1	6 18
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	88½	—	*5 13
do. do. Preferred	"	5	96/-	89½	—	*5 7
do. do. Deferred	"	5	120/5	111½	—	*5 16
do. do. Deb.	"	4½	4½	80½	—	5 5
Lond. & Sub. Trac. 5 % Pref.	1	5	2½	6/6	- 6d.	7 13
London United Tram. Deb.	Stock	4	4	53½	—3	7 4
Mexico Trams. 5% Bonds	—	Nil	5	12	—	6 19
do 6% Bonds	—	Nil	Nil	56	—	Nil
Mexican Light Common	100	Nil	Nil	24	+1	Nil
do. Pref.	100	Nil	Nil	53½	-2	Nil
do. 1st Bonds	—	5	5	66	—	7 11

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	20	12	2⅜	—	*4 11
British Aluminium Ord.	1	5	5	29/3	+1/-	3 8
British Insulated Ord.	1	15	15	3	+ ⅛	5 0
Callenders	1	15	15	2⅜	—	5 6
do. 6½ Pref.	1	6½	6½	93/9xd	+6d.	6 9
Crompton Ord.	1	5	Nil	10/-	+ ⅛	—
Edison-Swan	4/-	7½	10	8/9xd	—	6 12
" 5% Deb.	Stock	5	5	81½xd	—	6 0
Electric Construction	1	10	10	1⅜	+ ⅛	5 9
English Electric	1	8	5	10/-	—3d.	5 4
do. do. Pref.	1	6	6	21/-	—	5 14
Gen. Elec. Pref.	1	6½	6½	23/3	—	5 11
do. Ord.	1	5	5	21/6	+6d.	4 13
Henley	1	15	15	2⅛	+⅛	5 3
do. 4½ Pref.	5	4½	4½	4½	—	5 6
India-Rubber	1	10	5	17/6	—	*5 14
Met.-Vickers Pref.	2	6	6	2½	—	6 8
Siemens Ord.	1	5	—	2/3	—	4 6
Telegraph Construction	12	20	20	28½	—	*4 12

*Dividends paid free of Income Tax.

Boiler-Room Practice.

Balancing Boiler-Room Heat.

By JOHN BRUCE, A.M.I.E.E.

(*Continued from page* 966.)

Table V is the one with which we are principally concerned, since it expresses the relation between the CO_2 content of the flue gases as would be measured by a CO_2 recorder, and the percentage of excess air with which combustion has been effected. It is of interest to compare at this point one of the formulæ offered for the computation of dry gas weights from the values of the gas constituents as would be determined by, for example, an Orsat apparatus:—

Weight of gas per lb. of *carbon* consumed = w.

$$w = \frac{11\ CO_2 + 8\ O_2 + 7\ N_2}{3\ CO_2}$$

Substituting in the above formula the calculated values for 20.0 per cent. excess air, Table V, we have:—

$$w = \frac{(15{\cdot}1 \times 11) + (8 \times 3{\cdot}5) + (7 \times 81{\cdot}4)}{(3 \times 15{\cdot}1)}$$

$$= 16.86 \text{ lb. of gas per lb. of carbon.}$$

In the case in question the weight of carbon consumed and appearing in the gaseous products of combustion is 0.69 lb. of carbon per lb. of coal. Therefore, the weight of dry gas per lb. of coal consumed is, from the above formula:—

$$16.86 \times 0.69 = 11.63 \text{ lb. of gas per lb. of coal.}$$

The calculated value of lb. of dry gaseous products of combustion per lb. of coal consumed is, from Table III, 11.614 lb., which, it will be noted, agrees to within 0.13 per cent. with the value determined by the volumetric formula. From the foregoing tabulated data of combustion quantities it is now a simple matter to evaluate the various losses involved throughout a predetermined range of final flue gas temperatures.

Since the loss due to the heat carried away in the products of combustion of the hydrogen constituent and the loss due to the heat carried away in the vapour produced by the evaporation of the moisture content are both unaffected by the percentage of excess air with which combustion has taken place, these losses will be considered first. The loss due to combustion of hydrogen consists of the sensible and latent heat carried off in the H_2O in the flue gases. The value of this loss, expressed in terms of B.th.u. per pound of coal as fired, can be calculated by direct reference to standard steam tables or from the following formula:—

$$\text{Loss in B.th.u.} = H_2\,9\,\{(212 - t) + 970.4 + .48\ (T - 212)\}$$

where H_2 = weight of H_2 per lb. of coal.

T = final temperature of flue gases, deg. F.

t = initial temperature, deg. F., of coal and air (assumed to be 70 deg. F. for case given).

970.4 = latent heat of steam, B.th.u. per lb., at atmospheric pressure.

0.48 = assumed mean specific heat of superheated steam at atmospheric pressure.

For the case given, and assuming the initial temperature to be 70 deg. F., the loss, in B.th.u. per pound of coal as fired and for various final temperatures of flue gases, is as set out in Table VI.

The moisture content of the coal (see ultimate analysis or Table I) is 10.00 per cent., and the loss from this source can be calculated by reference to standard steam tables or by substituting weight of moisture per pound of coal for the factor $H_2 9$ in the previous equation. Again assuming the initial temperature to be 70 deg. F., the loss due to the heat carried away by the moisture content of the coal is, for the case given, shown in Table VII.

The next step is the computation of the heat loss due to the heat carried away by the dry products of combustion, and, unlike the previous losses discussed, this loss will be affected by both final flue gas temperature and the percentage of excess air. The loss, expressed in terms of B.th.u. per pound of coal as fired, is calculated from:—

$$.24\ w\ (T - t)$$

where w = weight of dry products of combustion, in lb. per lb. of coal as fired.

T = final temperature of flue gases, deg. F.

t = initial temperature of combustible and air for combustion, deg. F.

For the case given, and assuming, as before, the initial temperature to be 70 deg. F., the loss in the dry products of combustion, expressed in terms of B.th.u. per pound, and for various final temperatures of flue gases and excess air percentages, is set out in Table VIII.

TABLE VI.—LOSS DUE TO COMBUSTION OF HYDROGEN (B.th.u. per lb.).

	Final temperature of Flue Gases, Deg. F.									
	250	300	350	400	450	500	550	600	650	700
Loss in B.th.u. per lb. of Coal ...	458	468	477	487	497	506	516	526	535	545

TABLE VII.—LOSS DUE TO MOISTURE CONTENT OF COAL.

	Final temperature of Flue Gases, Deg. F.									
	250	300	350	400	450	500	550	600	650	700
Loss in B.th.u. per lb. of Coal ...	113	115	118	120	122	125	127	129	132	134

TABLE VIII.—LOSS IN DRY PRODUCTS OF COMBUSTION (B.th.u. per lb.).

Temp. of Gases, Deg. F.	Per Cent. Excess Air.										
	0%	20%	40%	60%	80%	100%	120%	140%	160%	180%	200%
250	420	502	583	664	745	826	907	988	1069	1150	1231
300	537	641	744	848	952	1056	1160	1264	1368	1472	1576
350	654	780	906	1032	1158	1284	1410	1536	1662	1788	1914
400	771	919	1068	1216	1364	1512	1660	1808	1956	2104	2252
450	887	1059	1230	1400	1571	1742	1913	2084	2255	2426	2597
500	1004	1198	1392	1585	1779	1973	2167	2361	2555	2749	2943
550	1121	1337	1553	1769	1985	2201	2417	2633	2849	3065	3281
600	1238	1476	1715	1953	2191	2429	2667	2905	3143	3381	3619
650	1355	1616	1877	2138	2399	2660	2921	3182	3443	3704	3965
700	1471	1755	2039	2322	2606	2890	3174	3458	3742	4026	4310

It was stated earlier that the loss due to combustible carried over in the ash would be taken as 1 per cent., which, with coal of 11,000 B.th.u. per pound as fired,

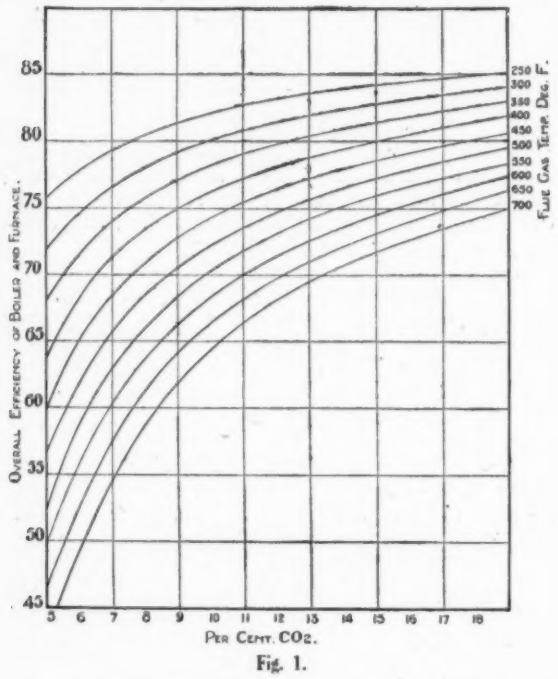


Fig. 1.

represents a loss of 110 B.th.u. per lb. The loss under the head of "radiation" has been assumed as 5.00 per cent., and this loss with the coal in question will be, in B.th.u. per pound of coal as fired, 5.00 per cent. of 11,000, *i.e.*, 550 B.th.u.

All the losses have now been enumerated, and the value of each, under the different conditions of excess air and final flue gas temperature, has been determined. Obviously, therefore, the boiler plant per cent. efficiency, under any given conditions covered by the range chosen, will be 100 per cent., minus the total losses under the particular combination of conditions. In other words, the boiler plant efficiency will be:—

Per cent. efficiency = 100 − (FG + H + M + R + CA),

where FG = per cent. loss in dry flue gases.
H = per cent. loss due to combustion of H_2.
M = per cent. loss due to moisture.
R = per cent. loss due to "radiation."
CA = per cent. loss due to combustible in ash.

Further, by totalling the losses, expressed as a percentage of the total heat in the coal as fired, for the various combinations of excess air percentage and final flue gas temperatures and subtracting these values from 100 per cent., a series of curves, for the temperature range chosen, can be plotted on a graph field with boiler plant per cent. efficiencies as ordinates and CO_2 percentages as abscissæ, from which the boiler plant efficiency can be estimated under daily operating conditions, from the indications of a CO_2 indicator or recorder and the temperature of the waste flue gases measured by ordinary thermometers, electrical resistance thermometers, or pyrometers.

With the data which have been determined to hand, the first step in the preparation of such a series of curves is the estimation and tabulation of the total loss, expressed in B.th.u. per lb. of coal as fired for each condition of excess air and flue gas temperature. It should be noted, as was pointed out earlier, that complete combustion of the hydrocarbons is assumed. The total loss for the case given and for the range of excess air and flue gas temperature values chosen, calculated as the sum of—

(FG + H + M + R + CA)

is shown in Table IX.

The per cent. efficiency of the boiler plant will therefore be:—

Per cent. efficiency = 100 × B.th.u. per lb. of coal − total losses in B.th.u./B.th.u. per lb. of coal.

which for the case given is—

100 × (11,000 − total losses)/11,000.

Substituting the losses for each set of conditions tabulated in Table IX in the above formula we get the following table of efficiencies (Table X).

It was shown in a previous article dealing with excess air and furnace efficiency that the percentage of excess air with which combustion has been carried out bears a definite relation to the CO_2 content of the flue gases. The determination of the CO_2 content, either indicated or recorded, is the most frequently adopted method for indicating combustion conditions; therefore CO_2 values, corresponding to the excess air values tabulated in Table X, have been substituted for excess air values in the graphing of the boiler plant efficiency curves shown in fig. 1.

(To be continued.)

TABLE IX.—TOTAL LOSSES (B.th.u. per lb.).

Temp. of Gases. Deg. F.	Per Cent. Excess Air. 0%	20%	40%	60%	80%	100%	120%	140%	160%	180%	200%
250	1651	1733	1814	1895	1976	2057	2138	2219	2300	2381	2462
300	1780	1884	1987	2091	2195	2299	2403	2507	2611	2715	2819
350	1909	2035	2161	2287	2413	2539	2665	2791	2917	3043	3169
400	2038	2186	2335	2483	2631	2779	2927	3075	3223	3371	3519
450	2166	2338	2509	2679	2850	3021	3192	3363	3534	3705	3876
500	2295	2489	2683	2876	3070	3264	3458	3652	3846	4040	4234
550	2424	2640	2856	3072	3288	3504	3720	3936	4152	4368	4584
600	2553	2791	3030	3268	3506	3744	3982	4220	4458	4696	4934
650	2682	2943	3204	3465	3726	3987	4248	4509	4770	5031	5292
700	2810	3094	3378	3661	3945	4229	4513	4797	5081	5365	5649

TABLE X.—BOILER PLANT EFFICIENCY. PER CENT.

Temp. of Gases. Deg. F.	Per Cent. Excess Air. 0%	20%	40%	60%	80%	100%	120%	140%	160%	180%	200%
250	85·0	84·25	83·5	82·8	82·0	81·3	80·6	79·8	79·1	78·4	77·6
300	83·8	82·9	81·9	80·9	80·0	79·1	78·1	77·2	76·3	75·3	74·4
350	82·7	81·5	80·4	79·2	78·1	77·0	75·8	74·6	73·5	72·4	71·2
400	81·5	80·2	78·8	77·4	76·0	74·8	73·4	72·0	70·7	69·4	68·0
450	80·3	78·8	77·2	75·7	74·0	72·6	71·0	69·5	67·9	66·4	64·8
500	79·2	77·4	75·6	73·9	72·1	70·4	68·6	66·8	65·1	63·3	61·5
550	78·0	76·0	74·1	72·1	70·1	68·2	66·2	64·3	62·3	60·3	58·4
600	76·8	74·7	72·5	70·3	68·2	66·0	63·8	61·7	59·5	57·3	55·2
650	75·7	73·3	70·9	68·5	66·2	63·8	61·4	59·0	56·7	54·3	51·9
700	74·5	71·9	69·3	66·8	64·2	61·6	59·0	56·4	53·8	51·3	48·7

New French Company.—A new concern has lately been organised in Paris with headquarters at 21, Avenue des Champs Elysées, a capital of 300,000 francs, and the title of La Société Pour l'Application des Véhicules Automobiles Electriques, to manufacture electric industrial vehicles.

Electrically-Driven Rolling Mills.

Some Recent Electrical Developments.

By L. ROTHERA.

(*Abstract of paper read before the* CLEVELAND INSTITUTION OF ENGINEERS *at Middlesbrough.*)

ALTHOUGH the last few years have seen the steel trade generally struggling against adversity, considerable progress has been made in several directions, and a number of interesting installations have been carried out and new developments considered.

Large Section Mills.—Two such equipments have been ordered within the last year or two, one for driving a cogging mill, and the other the roughing and finishing train of a rail mill; both are of the reversing type fed from flywheel equaliser sets, and the last named has been successfully put to work. The peak powers of the mill motors are respectively 13,800 h.p. at from 60 to 150 r.p.m., and 8,600 h.p. at 60 r.p.m.

A development in the method of control of the second equipment enables the more usual quick-excitation resistances in the fields of the mill motor and variable-voltage generators to be omitted, and quick acceleration obtained by special windings on the exciters which has the effect of reducing the size of the exciter motor by approximately one-half. As this machine runs continuously at approximately full load, there is on an equipment of this size a continuous saving of roughly 50 kW, which over a 6,000 hour-year, represents a very appreciable amount. A second modification is the use of an oil servo-motor for operating the main controller, which allows this important piece of apparatus to be placed in the power house away from metallic dust and, at the same time, reduces the physical effort of operating the controller to a negligible amount.

Plate Mills.—The controversy as to the advantages of the two-high reversing mill and the three-high continuous running mill still persists, and the two latest equipments set to work are both of the three-high type. The equipment at present being constructed for the Newcastle district consists, however, of a reversing slabbing mill, a reversing two-high large plate mill, and a three-high light plate mill. The large plant recently installed in Lincolnshire is of the reversing type, as is also a universal plate mill being constructed for Scotland.

The drive of the three-high mills mentioned is, in the one case a 3,000-h.p. motor coupled direct to a 50-ton high-speed flywheel and reduction gear to the mill, whilst in the second case an exactly similar drive was installed as would have been the case for a reversing mill; the motor is directly coupled to the pinions, and has a peak power of 13,000 h.p. at 55 r.p.m. The peak powers in the case of the slabbing and large plate mill are respectively 14,000 h.p. at from 50 to 120 r.p.m., and for the light three-high plate mill 2,500 h.p., working in conjunction with a 35-ton flywheel and geared down to the mill; the universal mill motor will have a peak power of approximately 11,000 h.p. between the speeds of 80 and 135 r.p.m.

The use of what is, in effect, a reversing-mill equipment for a three-high plate mill is the first example in this country of such a drive. The flywheel set is driven by a 2,500-h.p. motor, and a 50-ton flywheel is mounted between the two generators which feed the mill motor. At first sight it would appear as though the capital cost of such an equipment would be prohibitive, as compared with the alternative continuous-running motor driving a flywheel and geared down to the mill. The new drive is, however, justified by the following considerations:—

(1) The speed of the motor is under the complete control of the operating staff, so that the earlier passes can be taken at a low speed, and the later passes at a high speed, the actual speed used depending on the class of material to be rolled. This has the advantage of much reduced shock on the mill and increased output, in that the finishing speed is not fixed by the speed requisite for the entering slab. In addition, the speed of the mill can be adjusted to the class of material being rolled, *i.e.*, a higher speed can be used for the lighter classes of plate, with a resulting increase of output. Without this possibility the speed of the mill has to be chosen to suit the heaviest class of plate rolled.

(2) The flywheel is removed from the mill where it is liable to cause considerable damage to the mill if a piece is wrongly entered, or some sticker occurs, and is mounted on a separate set independent of the drive.

(3) The use of heavy gearing between the motor and the mill is avoided with its attendant upkeep and constant loss.

(4) A smaller flywheel can be made use of, as with an Ilgner drive a 20 per cent. fall in speed is permissible, which is greater than is allowable in the case of the direct drive, both from the point of view of speed variation on the mill and power loss in resistances.

(5) Taking into account the possibility of variable speed, *i.e.*, if a variable-speed set is used direct on the mill, the difference in capital cost is of only quite small proportion, particularly if at least one spare set of pinions is carried.

A suggestion which will very probably be put into operation is that the first few passes, with the three-high mill driven in this manner, should be taken reversing. The time intervals between passes to begin with is from 4 to 5 seconds, whilst as the plate becomes thinner this time is reduced to 2 seconds. If the first passes were taken reversing, the intervals would be reduced so that from 10 to 15 seconds would be saved on each piece. Assuming a 2-ton slab and an output of 40 tons per hour (*i.e.*, 20 slabs) the saving in time would be from 3¼ to 5 minutes, or an increase in output of from 6 to 9 per cent. In addition, the shock on the mill, which is very heavy on the first passes, would be enormously reduced, and the number of lifting table operations materially curtailed. Such an arrangement would appear to embody very largely the advantages of both types of mills.

In the case of the equipment for the Newcastle district, the slabbing and large plate mills are both reversing and a complete Ilgner set is provided for each motor, but the two are arranged in line and will normally run coupled together so that the diversity factor of the two mills will come into play and the demand from the flywheels will be reduced.

The final decision as to the merits of the three-high or two-high mill may in the end depend on the circumstances of the case, or the predilection of the purchaser.

Sheet Mills.—Six new equipments have been purchased within the last year or two, the horse-powers ranging from 600 in the case of a two-mill drive to 2,000 in the case of an eight-mill drive; one has a d.c. direct-coupled low-speed motor mounted on the flywheel shaft and fed from a transformer rotary, one is rope driven, and four are gear driven.

From an efficiency point of view the relative order of merit is:—(1) Direct drive, (2) gear drive, and (3) rope drive, based on the power losses in transmission and liberation of flywheel energy, which are least in the first case even after taking into account the losses in the conversion plant. This saving in losses will be from 7 to 8 per cent. and will, in most cases, justify the extra capital cost involved.

Merchant Mills.—Under present conditions a mill doing "jobbing work" must have the most efficient drive in order to meet the severe competition which inevitably means an extension of the electrical drive. A considerable number of such conversions are proceeding at the present time, the size of motors ranging from 150 to 600 h.p. The variable-speed motor should be installed for all such drives, but owing to lack of capital, the cheaper single-speed drive has been adopted in a number of cases, and militates against the output of a mill owing to the fact that the speed must be chosen to suit the heaviest material which requires rolling at the lowest speed. A compromise has been effected in a number of cases by making use of a two-speed cascade machine. In this case also the d.c. drive, in spite of the fact that in most cases 3-phase power has to be converted by transformer rotaries, will show an efficiency saving over the 3-phase motor as well as have the advantage of variable speed.

Continuous Mills.—The introduction of continuous mills proceeds only slowly in this country, the general feeling having been that the output from such a mill is greater than can be satisfactorily disposed of. It is, perhaps, early to dogmatise, but two such mills—one in Manchester and one in Newport—have managed to keep very satisfactorily employed in recent years, and assuming that they can be fed with orders, the capital cost is justified by the reduced cost of manufacture. The latest mill of this type installed is the one at Newport, which is rolling strip as its general product, but it has been recently stated that the design allows for easy conversion to rod rolling if at any time it is desired to do so.

In the last few months an order has been placed for a further continuous mill, but in this case it is for rolling copper rod which will be subsequently drawn down to suitable diameters for electric cable work. Unfortunately it has been ordered from the Continent on the ground that no maker in this country had the necessary experience to build such a mill.

It is surprising in these days to find how frequently the argument is still used that there is no point in increasing the output from the mill because it is impossible to sell the increased product.

Recent Progress.—Power companies frequently make new contracts subject to a proviso that a definite power factor shall be guaranteed; the figure chosen is usually 0.8, although

one power company is now insisting on unity power factor. It is difficult to obtain even as high a p.f. as 0.8 when 3-phase drives are adopted, owing to the fact that the average load on a mill motor is necessarily very much less than its normally rated capacity. In the case of a sheet mill the average load approximates to one-third, and in the case of a merchant mill to one-half. This, in conjunction with what is usually a comparatively low-speed motor, will bring the power factor somewhere in the 0.7's, and if there are a large number of intermittently rated auxiliary machines, the overall power factor may even be as low as 0.6.

Conversion to d.c. gives unity power factor, and by the use of static condensers, or of synchronous motors running idle (or preferably driving some constant-power machine) the p.f. is usually raised to something of the order of 0.9. Two comparatively new devices are now being made use of for certain applications where no speed drop is necessary on the drive for purposes of liberating flywheel energy. The first is the "asynchronous/synchronous" machine that consists of an induction motor which (when up to speed) has the rotor energised by d.c. which produces definite poles on the rotor which lock into engagement with the poles of the stator. During the starting period, full torque, or even more, is available for accelerating, and as soon as synchronous speed is reached the closing of a switch connects an exciter to the rotor, causing it to operate as a synchronous machine which, by over-excitation, can have a leading p.f. up to approximately 0.7. A machine of this type, if overloaded, will fall out of step as a synchronous machine, but will continue to run as an induction motor until the load conditions decrease, when it will again pull into step.

The second development is the use of an oscillating phase advancer connected in the rotor of an ordinary induction motor. This device is very compact and of small first cost, and can be used to increase the p.f. of the motor to which it is attached to unity. It injects a leading current into the rotor of the motor which provides magnetising current for the stator and removes from the line the corresponding wattless current. It has, in addition, the effect of increasing the pull-out torque of the motor to which it is attached, whilst slightly increasing the drop in speed from synchronism. A recent example of such an equipment is on a Pilger mill in the Birmingham district, and before its introduction the p.f. of the motor varied from 0.91 to 0.92, lagging, at approximately full-load. Since adding the phase advancer the p.f. has been improved to 0.9, leading, at anything between two-thirds and full-load. The effect is so satisfactory from the customer's point of view that three further equipments will be installed. The cost is, roughly, £1 per kVA of wattless leading current, and devices of this nature have been standardised up to a maximum of 300 kVA.

A third development is in connection with reversing mill drives. The use of pinions has been accepted as inevitable for reversing mill drives, with the enormous cost of the modern machine-cut pinion and housing and its cost of upkeep and loss of efficiency. During the war, in place of pinions, plain barrels were used in the case of a large plate mill, but it is very doubtful whether such a method would be satisfactory for a cogging or section mill.

Through the kindness of one of the steel works an experiment was recently carried out to test the validity of the claims made for an electrical drive which rendered the use of pinions unnecessary, and the results obtained were such as to prove beyond doubt that equally good results from the rolling point of view were obtainable by this method. The plant in question is a three-stand mill in line, the cogging end driven by a reversing motor with a peak of 12,000 h.p. and the finishing end by another reversing motor of 19,000 h.p. The stands being in line, it was possible to connect all the bottom rolls together and to drive them from the cogging mill motor and to connect the top rolls to the finishing mill motor, the pinions being disconnected from the rolls. One of the flywheel equaliser sets was used for providing the necessary power for the two motors, the armatures of which were connected in series. Ingots were brought from the soaking pits in the ordinary way and rolled out to flats, and the mill operated quite satisfactorily.

This represents a very marked advance in rolling mill practice, and opens a wide field for economy in the operation of reversing mills, both on the score of capital cost and of running cost, and there would not appear to be any material disadvantage which can be set against the drive. The advantages which may be claimed are as follows:—(1) Reduction in first cost; (2) elimination of power losses in pinions; (3) reduction in pinion upkeep; (4) possibility of controlling the relative torque between the upper and lower rolls, *i.e.*, these torques can be made equal, or different, as desired; and (5) automatic correct setting of the speed of the rolls to the peripheral speed of the metal passing through. Advantages (4) and (5) can be amplified as follows:—A piece passing through the rolls, instead of coming through straight, may tend to bend either up or down, due to a number of causes; when consistent it is due to the stretch on one side of the piece being greater than on the other. Supposing the piece tends to turn upwards and the torque of the top roll is increased relatively to that of the bottom, the effect will be to cancel out the difference in stretch and so produce a straight bar in place of a curved one. Advantage (5) is, from the operating point of view, of the greatest importance. Taking the simplest case of a plate mill, the effect of tying the two rolls together through a pair of pinions is to keep the number of revolutions per minute the same, so that with different roll diameters different peripheral speeds must inevitably occur on the top and bottom roll. This necessarily introduces very heavy strains on the spindles and boxes, and is so serious that various devices of slipping clutches have been patented to allow one roll to slip relatively to the other; not only are heavy strains set up, but there is a tendency for the plate to bend instead of coming out flat. Under the new conditions, the peripheral speeds of the rolls automatically set themselves to the speed of the plate, so that (taking an extreme case) if one roll was half the diameter of the other it would automatically run at twice the speed. In the same way in a section mill, the two rolls would set themselves to the mean speed of the metal, and in both cases heavy wear on the rolls and large loss of power would be avoided.

A mechanical friction device between the two rolls to ensure simultaneous reversal is avoided by the use of a simple electrical connection. The generators are in series with the mill motors, so far as their main connections are concerned, but there is a third wire connection between the two in which is embodied a certain resistance. The third wire, in effect, places the two motors in parallel and allows sufficient current to pass on reversal to make the motors reverse simultaneously, whilst at the same time preventing the flow of sufficient current to interfere with the series characteristic of the two motors, which is the feature that automatically produces the correct speed relationship between the motors to give an equal peripheral speed setting of the rolls. The use of two motors does not involve any additional electrical apparatus, as in most large reversing mills a double-armature is employed in any event.

There have been a number of cases recently in which definite statements have been made to the effect that it is cheaper to roll by steam, but after investigation the exact opposite has been proved. The case is altered where a central boiler plant is installed, particularly if electrical power is being generated in the works themselves. The conditions in a steel works usually lend themselves to the economical generation of power in the works, largely due to the very high load factor obtained on the generating plant, which may be anything from 60 to 80 per cent. Under certain conditions a considerable quantity of heating steam is required for pickling vats, &c., and an added source of economy is obtained by installing either a pass-out turbine or drawing steam from the turbine after it has done a considerable amount of work. Given a modern up-to-date turbine plant of reasonable size, it should be possible to generate under ordinary steel works conditions at under ½d. a unit, this figure taking into account all charges and running costs.

An interesting development in rolling mill practice is the use of roller bearings for the mill trains. Such bearings have been in use now for between two and three years on the finishing train of a strip mill, and have given very satisfactory service, and a most remarkable reduction in the power required to roll. In certain classes of mills, such as sheet mills, the bearing losses may approximate between 50 and 60 per cent. of the total load, whilst in cold rolls for sheets or tinplate the friction load is practically the complete load, *i.e.*, there is no appreciable difference in power with the rolls empty and with sheets being mangled.

The importance of reducing friction losses is very well exemplified in the case of a particular tinplate works where the cold rolls operate only eight hours out of the 24; the charge for power is based on the maximum demand system, so that year in and year out the charge is on a basis of 510 kW, whilst the average demand is 360 kW. The extra cost due to the operation of the cold rolls is over £1,000 per annum, so that there is a very large saving to be made by the reduction of the cold roll friction losses. In addition to the actual saving in power cost, there should be a very material reduction in general upkeep.

Discussion.

Mr. H. B. Toy (president), who opened the subsequent discussion, expressed doubt concerning output when separate motors were used for the rolls, but said it would be a great advantage if roller bearings could be devised satisfactory to rolling mills; the friction on the necks of the rolls was enormous.

Mr. Crow defended electrical engineers against any allegations of lethargy, saying that the management and directorate were generally the seeming obstacle, but the Cleveland district was, at any rate, progressive in electrical development. The double-motor suggestion might prove one of the greatest developments of rolling-mill practice in modern times. Personally, he thought there would be nothing to beat three pairs of rolls with six motors—and no pinions.

The Chairman observed that Mr. Crow would have little difficulty in persuading electrical companies to agree with him on that point.

Mr. R. Archer Coulson (Skinningrove Iron Co.) said that auxiliary motors had to do a tremendous amount of work in rolling mills, and it was in that direction more than to the main drive that the electrical people should direct their attention.

Speeding up the Telegraph Service.

A Forecast of "The New Telegraphy."

By DONALD MURRAY, M.A., M.I.E.E.

(Abstract of a paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper, which foreshadows the doom of the telegraphist, is mainly a forecast of the probable form that the telegraph service will take in the course of the next 25 years. The author has avoided technicalities, and communication engineers will find nothing new in it, but the subject dealt with is of some importance to commerce and industry, and the fact that official steps are said to have already been taken to test the scheme proposed is regarded as proof that the idea upon which the paper is founded is of practical importance. The keynote is that "the era is beginning when typewriter keyboards in the offices of business men will not merely type letters, but will type and transmit telegrams to correspondents in any part of the world."

Briefly, the idea is that start-stop printers will enable subscribers to communicate direct with each other by means of typewriter keyboards over almost any distance much more rapidly than by present telegraph methods, and much cheaper than by long-distance telephones. This result will be achieved by printing telegraph exchanges similar to telephone exchanges, and the telegraph administrations will connect printing telegraph subscribers through to other subscribers exactly as in the case of telephone calls, which scheme it is claimed will effect a vast change, and will give a much quicker, cheaper, and more accessible telegraph service than is at present enjoyed.

Three of the T's, namely, the telephone, typewriter, and typist, are already indispensable to the business man, and the author's paper is devoted to the fourth, the Teletype,* which is, as its name implies, a simple telegraph machine which types and transmits telegrams. Many have already been installed in the British telegraph service and by the Eastern Telegraph Co., the Marconi Co., banks, and other business concerns.

At present the telephone has no effective rival, and it has interwoven itself into the industrial life of the world to an extraordinary degree; but a telephone message is a voice and nothing more—a sound leaving no record. It is a sight, and not sound, record that is needed for business purposes, and with the telephone the risk of error is great; also it is only possible to speak on the telephone "simplex," that is to say, one cannot talk and listen at the same time. The telegraph can do so; it can work "duplex." The telephone needs two lines, but the telegraph only requires one wire at about half the cost of the telephone wire. This means that for long distances the telegraph is far cheaper than the telephone, and telegraph printers offer the notable advantage of recording messages in the absence of the addressee, thus avoiding interruption of work and delay.

Practical men realise that telegraph traffic is not likely to grow faster than the slow annual increment due to the increase of population, if the present lines of development are adhered to, and they know there are only two other directions from which increased traffic can be expected. The obvious remedy is to attack the telephone and make war on the mail bags. Advertising shows that the Western Union telegraph plant is not being used up to its capacity, and that is the position with all telegraph administrations. It is not much good advertising the telegraph service while it is dear, slow, and inaccessible.

To a substantial extent the telephone is doing work that the telegraph could do better, especially over considerable distances, but the telegraph has been cramped between the competition of the telephone and postal services. This stunted growth is economically unsound, and has been due essentially to the imperfect development of the telegraph plant. It is true that the telephone also is only now reaching the machine stage; but the telephone has always had the great advantage that the transmitting and receiving mechanisms, the human tongue and ear, cost nothing, are ready made, highly perfected, and capable of any speed up to about 150 words a minute. All the telephone engineer had to do was to provide wires and suitable switching arrangements and extremely simple devices to catch and reproduce the human voice. The telegraph engineers, on the other hand, were heavily handicapped by the burden of having to make satisfactory machinery that would typewrite at a distance, which proved to be a very difficult task. This is the one and only important reason for the backward condition of the telegraph as compared with the telephone. The telegraph can never be as quick and as intimately connected with the life of the community as the telephone, but in 15 or 20 years business men will have at their disposal a telegraph service, by wire and "wireless," far quicker and more accessible than the present one, and progressively cheaper than the telephone for distances exceeding, say, 50 miles.

There is a practical limit to the rate of electrical vibration and also to the variation of amplitude that can be transmitted over any given size and length of wire, and the longer the wire the lower the limit. It is this fact that imposes a handicap of 40 or 50 to 1, and even 100 to 1, on the telephone, as compared with the telegraph.

The defects of the telegraph are not due to lack of circuit facilities; there are enough circuits to carry more than double the present available traffic. The shortcomings are due almost entirely to defective terminal facilities (machinery); we see good organisation and capable management, but also excessive development of circuit facilities, and the ease and cheapness with which telegraph circuits can be created by superposition on telephone trunk lines adds to the present superfluity of telegraph circuits. The present telegraph plant of the world, wire and "wireless," can handle twice the present volume of traffic and technical developments can multiply the present telegram carrying capacity by 10 and even 20.

But big users require a linkage that will put them directly in touch with their correspondents, just as the telephone does, and the typewriter keyboard should be as supreme in telegraphy as it is in business.

The defective terminal facilities are due to a variety of causes, amongst others to lack of faith and foresight on the part of telegraph administrations, and to a determination to buy cheaply by encouraging competition to such an extent that telegraph manufacturing does not pay. It is only just dawning on the telegraph world what an immensely important thing the start-stop printer really is; it is the long-sought missing link. In France considerable importance appears to be attached by technical men to the possible use of the Teletype in conjunction with the telephone for working through telephone exchanges, but it would appear to be better in all respects to have separate Teletype exchanges.

Although there are engineering difficulties, it ought to be practicable for a subscriber having one telephone line and a Teletype to ring up the exchange and be plugged through to the Teletype section, and to have his message typed direct at its destination. The exchange plan will in time effect a complete revolution in methods and organisation in head telegraph offices which will be provided with automatic telephone exchange equipment for the Teletype exchange. The telegraph operator will disappear for the same reason that the telephone girl is being driven out by the automatic telephone switch.

In a large manufacturing plant, for example, there would be a private branch Teletype exchange, as well as the usual p.b. telephone exchange. Orders and other departmental communications that have to be typed would go through the private Teletype exchange, and any department could at once send a telegram through the Post Office direct. In future, when there will be a dozen Permalloy Atlantic cables in use, each working at 300 words a minute in each direction simultaneously, all sextuple duplex multiplex, there will be no difficulty in sending a message from any department of a manufacturing plant in England to an American city, and getting a reply within 10 minutes. The circuit facilities will be still greater when half a dozen "wireless beams" work across the Atlantic, each at 300 words a minute. There must be healthy growth from small beginnings. A start has already been made in connecting business firms and banks to the Central Telegraph Office, London. The Dutch Government has installed a considerable number of Teletypes for this purpose and the British Post Office is beginning to do the same. If this service grows it will lead to a concentrator system, because subscribers' lines will not always be busy, and a considerably smaller number of Teletypes at the Central Telegraph Office than the number of subscribers will be able to handle the traffic by means of a concentrator switch. It seems reasonable to suppose that this arrangement will gradually extend to switching subscribers direct to the particular circuits over which their telegrams would have to be transmitted. The British Post Office already has Teletypes in use on long lines, and "through switching" would appear to be inevitable in the course of time.

Success will depend on the rates charged. The charge for Teletype service should be considerably below the telephone rates, say, 1s., or even 6d., for three minutes between London and Birmingham, compared with the telephone charge of 2s. 6d. The danger is that the charges may be fixed at the same rates by administrations anxious to protect their long-distance telephone profits. In that case "the new telegraphy" will be strangled at its birth.

* ELECTRICAL REVIEW, September 8th, 1922.

Discussion in London.

Mr. D. Murray read his paper at the Institution on December 18th, illustrating it with a number of slides depicting various pattern of Teletype machines, including those of the Morkrum Co., Siemens & Halske, and Creed.

Col. T. F. PURVES, O.B.E. (Engineer-in-Charge of the G.P.O.), in opening the discussion, said that the Post Office felt the keenest interest in Mr. Murray's proposals, and it was intended shortly to try the system under the most favourable conditions. He agreed with the author as to the lack of terminal facilities, but he thought that the contention regarding the limitations in speed of the telephone was not to be taken too seriously. The transmission of news by telephone could be most rapid and accurate, and Mr. Murray was less than fair to the possibilities of broadcasting. Nevertheless, the paper was a valuable contribution to the revivifying of the telegraph service. The start-stop system was not ideal outside office hours. The author claimed that messages could be "stored up," but few business men would take the risk of placing valuable information at the disposal of unauthorised persons—and there might be "wrong numbers." The system was inferior to the telegraph in that respect. As regarded automatic switching, there was a proposal several years ago to convert the London telegraph system to this method, but it was foreseen that the competition of the telephone would nullify this.

Mr. J. NEWLANDS confessed that he could not see so far telegraphically as the author. The telegraph system had grown like a tree—with a main trunk and innumerable branches—and, unfortunately, it was still too much like a tree. There were too many transmission points. Although operators were undoubtedly slow, and Mr. Murray would abolish them all, the Teletype was at present far too costly. No doubt a group of busy offices could be connected up to effect economies. He (the speaker) would like to see the telegraph system absolutely reorganised. There should be a number of main centres, each within reach of the whole of the area around it; this would save a great deal of the re-handling which made the system so costly. Mr. Murray's scheme for world-wide Teletype communication would suffer from the defects inherent in the telegraph system —cable "bottle-necks." He did not think that there was a case for the Teletype system in London, the telephone was quite adequate. If there was a demand in the country for the Teletype system, however, it should be connected with the telegraph, not the telephone system. The Post Office should place one good line between two important centres to see what business it would attract. There was no doubt that the system had great possibilities if it could be cheapened.

Mr. E. H. SHAUGHNESSY, O.B.E., considered that Mr. Murray had prophesied too much, and that his criticisms of "wireless" were not fair. The rapidity of the proposed system and its "storing up" feature were somewhat nullified by the excessive cost. If the system was to come into vogue it would have to be considerably cheapened. The paper no doubt demanded serious consideration.

Mr. J. E. KINGSBURY said that the paper showed considerable vision, but he doubted whether it would be possible to introduce the system. In railway systems the best stock was reserved for passenger traffic, and there were facilities for the carriage of goods. In communication speech was the passenger traffic, and the written word represented goods. The terminal facilities for goods were only used by people with a great deal of goods to dispatch. The telegraph to-day collected in detail, forming a bulk, and distributed it in detail. The Teletype was designed to afford direct communication, but it was dependent upon the simultaneous desire of people to utilise it. Opportunities should certainly be given for the testing of the system, in the first instance in a telegraphic exchange. He had considerable apprehensions regarding the addition of the system to the telephone—it was like using the passenger service for the conveyance of goods.

Mr. J. H. JOHNSON thought that the crux of the matter was the extent to which business men required a written record of their transactions. He found that there was an extraordinary reliance on the spoken word, but the field for the written word could be filled by this or a similar system. If the Teletype could be put through from a short line on to a long one there were great possibilities for it. The labour-saving attributes of the machine, with decreasing cost, made it worthy of consideration. A great deal of handling of messages, with additional risk of error, could be saved by the system. He could not agree that farmers would take it up—it had been found necessary to practically abandon telephone weather forecasts because of the small use made of them, although they were supplied *gratis*. Moreover, the carelessness of the average user would be fatal to the system. There was no doubt, however, that a successful type-printing telegraph would lead to the abolition of the sounder. The system could only be made to "take on" by an unprecedented advertising campaign.

Mr. A. E. THOMPSON said that in comparing the relative transmission efficiency of the telephone and telegraph, Mr. Murray did not consider the harmonics which were necessary to machine telegraph speed. The Western Union Co.'s voice-frequency telegraph had enabled 12 telegraph channels, each equipped with a quadruple multiplex circuit, to be used. The Bell Co. of the United States had for many years leased telegraph lines. There was a need for a standard 5-unit code and that employed by the Teletype was the most suitable for all purposes.

Major F. H. MASTERS, O.B.E., said that Mr. Johnson had mentioned the incompetency and carelessness of the telephone subscriber. It was rather interesting to note the remark by a Post Office official because they were soon to have automatic telephones, and in that event he wondered how the subscriber would be able to get a number at all. The same speaker had complained of the manner in which the public did not avail itself of the facilities now open to it. The Post had recently been formed a Telephone Development Association, and it should be part of the duty of that body to bring this to the public notice; he asked the author if he did not think that some of the things at which he was aiming would be obtained more simply by using the telephone in connection with the telegraph. If they could envisage a time when everybody would have a telephone, then surely it would be sufficient for most people to have a telephone by which they could telegraph.

Mr. W. J. THORROWGOOD said that if they were to look years ahead with regard to the development of the telegraph, they must not forget that the telephone would also improve during that time. The paper had looked at the matter from the point of view of the telegraph and telephone engineers, but had rather overlooked the view of the user, and it could not be denied that the cost, on the basis of the paper, would be very high. Moreover, if the two systems were worked over the same lines, the Teletype system would be a bugbear, and, on the whole, he did not believe the Teletype system would stand a chance at all with business men in the manner suggested.

Mr. A. C. BROWN pointed to the telephonograph as an instrument which was already in existence for writing telephone messages, but was not referred to in the paper. It seemed to him that this went some way to fulfil the claim of the author whilst it did away with a good many difficulties connected with switching.

Mr. STUART JONES did not agree that there were too many telegraph circuits in this country at the present time, as suggested by the author, who was supported by Mr. Newlands. There were very few telegraph routes at present consisting of more than two wires, although there were a few reserve wires for emergency. Mr. Murray was wrong in thinking that his system would appeal greatly to business men, because the number of telegrams sent by individual people in this country was certainly not more than three per day, and of the 250,000 telegrams handed in daily in this country, 200,000 of them were by different individuals. He did not think that there would be sufficient business for Teletype exchanges to justify the revolutionary change outlined in the paper. On the other hand, the author was probably right in suggesting that there would be possibilities for the Teletype exchange in the big towns and for inter-communication between one town and another, although he did not think it could possibly reach the dimensions envisaged in the paper.

Mr. D. MURRAY said that the discussion had really been unexpectedly favourable because he had thought he would be severely attacked. Owing to the shortness of time and the desire for some of the instruments exhibited to be demonstrated, he would postpone his full reply for the *Journal*.

Textile Mill Electrification.—An announcement that 2[illegible] of the large textile mills of Blackburn have adopted electricity for power purposes, and other other factories are on the waiting list, forms part of a remarkable story of electrical progression in industrial Lancashire. A great electrical chain, linking up town and country, is already assured from Colne to the Fylde Coast, and Lancashire will shortly have a network of cables available for public, industrial, and private supply purposes. An official of a cotton manufacturers' association stated recently that remarkable developments were slowly but surely making their influence felt, and he expressed the opinion that within the next few years it would be the rule rather than the exception to have manufacturing machinery run by electric power. The rate of progress depended on the cheapness of the necessary plant and also on whether controlling authorities were able to afford supplies at reasonable cost. Northern medical authorities were constantly calling attention to the fact that atmospheric pollution was a prevalent source of disease, but if power progress was maintained, the smoke evil promised to be almost eradicated within a generation.—*The Times*.

An Irish Appointment.—Our correspondent in Belfast writes:—"Newry Urban Council last week considered applications from electrical engineers to carry out its electric lighting scheme at a cost of £17,500. There were 10 applications, but the voting rested between Mr. P. A. Spalding, A.M.I.E.E., electrical engineer to Dundalk U.D.C., and Mr. W. Pleasance, M.I.E.E., Belfast, who acted as an expert in advising the Council, in co-operation with Mr. A. E. Porte, Dublin. On a strictly party vote, Mr. Spalding was elected by 12 Nationalist votes to six Unionist votes cast for Mr. Pleasance. The five Unionist members of the Electricity Committee (including Mr. Robinson, the chairman) thereupon resigned as a protest."

The Need for Advertisement.

At a salesmanship conference on December 19th, Mr. V. W. Dale, business manager to the British Electrical Development Association, read a long and detailed paper entitled "Advertising and its Relation to the Sales Force." Owing to an accident Mr. G. W. Partridge was unable to take the chair as previously arranged, and his place was taken by Mr. J. B. Mitchell, of Glasgow. The paper was a strong plea for more advertising on the part of all branches of the industry, with, at the same time, a mass of useful information as to the best means of going about the matter. The author stressed the fact, in the first instance, that 40 years after its inception, and in spite of the fact that electricity supply was available to 28 million people, representing 74 per cent. of the population of these islands, our progress had been so slow that less than 15 per cent. of that number were at present using it in any shape or form in their homes. This was because we had failed lamentably to adopt the only possible means of telling the public how. Hundreds of thousands of people quite capable of taking a supply hesitated for no better reason than that they still regarded electricity as inaccessible to them. Most glaring cases had come to his notice, and he was not sure that penny or even halfpenny units meant very much to this great class. As a slight indication of the field immediately available—in one direction only—he mentioned that there were over 1,500,000 houses in Great Britain with rentals between £20 and £100 with more than six million middle-class people living in them. Again, 42 per cent. of the people lived in or within five miles of the 16 largest towns, a condition of affairs in itself favourable to mass effort in the national Press. He did not suppose that any retailer would challenge him when he said that even in the electrical industry neglect to stock advertised articles meant loss of business. In the past, national advertising had been restricted to lamps to a large extent, but he had been told that the recent advertising of vacuum cleaners and fires on a fairly generous scale had produced the most gratifying results.

Speaking of the advantages of individual advertising, as distinct from national advertising, Mr. Dale called attention to the recent issue by the E.D.A. of a book containing 31 specimen advertisements suitable for insertion in local papers and magazines. He then proceeded to discuss what percentage of costs or turnover should be expended on advertising. He said that large electrical firms in the United States allocated some 20 per cent. of their total sales costs to advertising. In this country, from inquiries made, it appeared to be from 3½ to 7 per cent. of the annual turnover in the case of manufacturers; in the case of supply authorities it did not seem to exceed 1 per cent., whilst in the case of contractors it was anything up to 5 per cent. In the author's opinion all three branches of the trade should spend at least 2 per cent. of their annual turnover in advertising, one-half to be devoted to national and co-operative effort and the other half to local effort. Mr. Dale then dealt at some length with the technicalities of advertising, including advice upon the objective in the particular advertisement, and the preparation of copy. In national advertising, and in local advertising, too, though perhaps in a different degree, he said they must first sell the idea and then the article. Stress was also laid upon the need for those in the industry who were endeavouring to persuade others to buy either current or apparatus and plant, to swallow more of their own medicine. If shop lighting were a cheap form of advertisement for their customers, it must be a cheaper advertisement for those in the industry whatever rates were paid for energy. Again, if electric sign advertising was a good thing for various other trades, surely it was equally good for the electrical industry itself. The flood-lighting of hoardings at night was another aspect of the question deserving greater attention than it had hitherto received.

The paper was more concerned with the national and the total effect, although it went into some detail regarding local advertising. During the past few years the E.D.A. has inspired a great deal more local and individual advertising than it has itself been in a position to do on a national basis. The author expressed the view that the limits of individual effort, on purely individualistic lines, were closely defined. Co-operation and co-ordination could not fail to add strength to the whole effort, and the hope was expressed that in the near future it would be possible, so far as the suppliers and contractors were concerned, and perhaps to a lesser extent the manufacturers, to be able to persuade those in control to divide their advertising appropriations into (*a*) national, and (*b*) local or individual, the direction and policy of the first group being entirely, and the second group partly, at any rate, organised by some central headquarters representing every interest in the industry. In the meantime, and until wider and more effective policies were evolved, it was urgently necessary to get the smaller firms and supply undertakings alive to the importance of taking their share in the important development work both in the form of supporting the main Association and also extending activities in their own areas in the directions indicated.

Discussion.

A large number of people discussed the paper from various points of view, those taking part comprising contractors, supply men, and advertising agents. The points of difference were as to policy and ways and means. The CHAIRMAN said that Glasgow did not spend anything like 1 per cent. of its revenue on advertising, but they had spent more this year than formerly, and intended to spend still more in the future. Mr. ROBINSON, of Hackney, was convinced that he was not spending anything like enough on advertising; he suggested that the greatest good would be derived from the paper if it were published in the I.M.E.A. *Journal*, and so came before those who had to sanction the spending of the money. Mr. W. A. GILLOTT spoke of committee members who still thought that electricity sold itself; he assured people with such ideas that the old saying that "Good wine needs no bush" was out of date. Mr. S. M. HILLS spoke of members of committees who regarded all advertising as a means of increasing the price of the article. On the question of publishing the paper in the I.M.E.A. *Journal*, Mr. BEAUCHAMP said that plenty of copies would be available for everybody.

Mr. W. A. GILLOTT spoke with regard to conveying the intended idea to the public. For instance, he mentioned a showroom which had a "penny" 10 ft. in diameter in the window, with the words, "Residential tariff, lighting, heating, cooking, cleaning, and ironing," but with no mention that the charge of one penny was "per unit." He said that this advertisement failed to keep touch with the public.

Mr. W. R. RAWLINGS and Mr. H. T. YOUNG spoke upon the education of the public by national advertising. It was suggested that the public was lamentably ignorant of what electricity was and what it could do. Mr. Rawlings spoke of the confusion created in the minds of the public by the old advertisements that electricity created no heat, and yet the public was now asked to use electricity for heating. Some people thought electricity for heating was of an inferior quality because it was offered more cheaply.

Opinions were a little divided as to the value of national advertising as against local advertising. Mr. C. H. RAYNER spoke of turning down a man who asked for an advertisement because his particular medium circulated all over the country. He did not, he said, wish to advertise Manchester electricity all over the country, and therefore he preferred local advertising and, apparently, did not desire to subscribe any funds to the E.D.A. for national advertising. Mr. S. M. HILLS considered that Mr. Rayner took too narrow a view, and urged a greater concentration upon national advertising. Mr. W. E. BUSH, of the E.L.M.A., as the result of his experience in lecturing all over the country, said that he was convinced that already a greater demand had been created than the supply authorities could meet; there were numbers of people who wanted electricity but could not get it. He suggested that any big national advertising campaign should be postponed until the facilities for supply were better, generally, although there was a rapid improvement taking place. Mr. J. W. BEAUCHAMP did not agree with this point of view, whilst Mr. DALE, in the course of his reply, disagreed with Mr. Beauchamp, comparing the situation with that of a man asking for a loaf of bread and being told that it would be available some time hence. National advertising must go hand in hand with development of facilities by the supply authorities.

A small point which received some attention was the use of testimonials as a means of attracting new customers. Some speakers would have nothing to do with them, being of the opinion that the public distrusted them and believed they were faked. On the other hand, Mr. ROBINSON, of Hackney, and Mr. RAYNER, of Manchester, said that they found them exceedingly useful locally, especially if reproduced in their original form, whilst Mr. Dale also favoured their use in this manner.

Among other matters mentioned was the importance of continually changing the subject matter of advertisements in trade papers and the need for special treatment of advertising matter in technical and trade journals, it being pointed out that those who read the trade Press did so for information as to latest developments and from a totally different point of view from the readers of the "lay" journals.

Mr. BEAUCHAMP sought to remove any impression that the E.D.A. wished to cut into the work of the regular advertising expert, but added that in preparing their matter they did seek the assistance of experts with special knowledge so far as the electrical industry was concerned.

The Whitworth Society.—The second annual Commemoration Dinner was held at the Holborn Restaurant, on December 20th, and proved a great success. Mr. R. B. Buckley, C.S.I. (the Senior Whitworth Scholar, 1869), presided and was supported by about 80 members. This year's Whitworth Scholars were invited as guests and six of them had accepted. The President announced that the Committee had elected Mr. Wm. Sisson, of Gloucester, as succeeding president.

Conditions in Argentina.

As briefly mentioned in our columns last week, Mr. H. O. Chalkley, C.B.E., Commercial Secretary at Buenos Aires, has presented a report upon the financial, commercial, and economic conditions of the Argentine Republic to the Department of Overseas Trade.*

In his introduction Mr. Chalkley says that the outlook, having regard to the anticipation of a successful harvest, is more favourable than at any time since 1920. Thus the prevailing spirit is one of optimism, despite the financial, legislative, and political handicaps which have to be borne. Such obstacles, possibly inevitable given the prevailing temperament, hinder the rate of progress, but cannot overcome the advantages of national resources, geographical position, and human enterprise which will enable the country to undertake the vast programme of public works—land settlement, roads, railways, irrigation, power schemes, port works, and the relief of the congestion in Buenos Aires—which are essential to further development. The improved outlook in Argentina and the more favourable course of exchange should be reflected in greater activity in the import trade in 1925, with an increased demand for goods which the United Kingdom can supply, but whether that demand can be transformed into larger orders for British goods, or whether it will be neutralised by intensified competition from Germany following the adoption of the Dawes Report cannot yet be seen. Mr. Chalkley reminds us that the first treaty between Great Britain and Argentina was signed a hundred years ago, and, looking back, no doubt remains that the confidence of the British investor has been justified. Although the direct financial return may have been modest, a multitude of indirect benefits have accrued.

Argentina is restrained from a return to the gold standard by an unmanageable floating debt, and it is still unable to balance its Budgets. The deficit in the last financial year was, however, smaller than was anticipated. An improvement in the exchange is noted; this will considerably reduce the losses in this respect incurred by British companies and investors.

Foreign Trade.

Imports during 1923 were valued at $868,430,096 (gold),† an increase of 26 per cent. as compared with 1922. In volume, however, the total (8,036,000 metric tons, including coal) fell short of the 1913 figure (10,130,000 tons). The Board of Trade statistics of British exports to Argentina during 1923 give a total value of £28,164,835, comparing with £22,668,618 in 1922, and £22,640,943 in 1923. During the first nine months of 1924 the total was set down as £20,324,453.

Exports during 1923 were valued at $771,361,262, an increase of 14 per cent. as compared with 1922. Great Britain's share of this rose from $150,264,485 to $188,915,282. The adverse balance of trade shown in 1923 was especially accentuated during the second half of the year (and so reflected in the exchanges), but a marked change occurred in 1924, caused by the reduction of imports on account of the new tariff, and an increase in exports. An unofficial estimate shows a favourable balance of over £30,000,000 for the first seven months of 1924.

In a detailed examination of the imports, Mr. Chalkley says that at present Belgium holds the market for constructional iron and steel, its prices being so low that even the local German Thyssen works has bought from Belgium. Tubes and fittings for gas, water, and steam are sold on the basis of the British standard list prices, but it has been very difficult for British firms to offer the discounts of German and Canadian manufacturers, who have done the biggest trade.

The Electrical Machinery Market.

In spite of the growth of the Argentine market for electrical machinery and material, conditions have been very discouraging for the increase of the British share, in consequence of German competition. Here, again, the chief reason is price, German makers even having been able to outbid others in insulated cables and wires. But Germany in this case has other advantages, in the shape of German ownership of most of the electricity supply companies; the absence of modern wiring regulations in Argentina, which permits the use of cheap and low-grade materials; and, further, large and well-known local branches of the German electrical trade and industry, which carry stocks, give technical service, and, whatever may happen in Germany, have always been willing to grant most extended credit terms. While Germany has secured the large Government contracts and also supplies the trade, British manufacturers are better placed for securing orders from British enterprises operating in the Republic, and should do everything possible to cultivate this connection.

Methods of Trading.

British trade with Argentina rests on solid and secure foundations. The greatest obstacle under present circumstances is the consideration of price, or, in other words, the competition of Continental countries with lower costs of production and depreciated currencies. British traders must keep up with the changing developments. Visits of representatives are the best way of doing so, but next in importance is attention to the special requirements of the market, and to the recommendations of agents and customers. In exceptional cases the establishment of a local branch gives an important and profitable advantage over competition, as seems to have been proved by the experience of certain American concerns. Co-operation with a local merchant firm by maintaining a special factory or technical representative to work in conjunction, has also proved, in certain cases, to be amply justified by results. It is important to find the right agent and to treat him liberally when he has been proved by experience to be satisfactory. Government purchasing departments award locally all their contracts, involving orders of great magnitude, and are developing more the construction of public works by administration rather than by contract or concession, so that a smaller proportion of contract business than formerly can be negotiated in London. Argentina is primarily a credit market, and credit is essential for British firms who want to do a direct business, a maximum business, and to retain a good agent.

Railways and Tramways.

Keeping pace with the continually increasing requirements of the country, the leading British railway companies are carrying out much work in the way of extensions, improvements, and replacements. The Buenos Aires Western Railway, having completed the electrification of its suburban system, has not undertaken new works during the past year, and no extensions are in prospect for the present. During the current year, however, the company will receive from the United Kingdom about 14 new electric coaches, and will install three more oil-burning boilers and a fourth turbo-generator in the power house at Dock Sud. This fourth set will necessitate the provision of two further boilers.

Although the four tramway undertakings in Buenos Aires and the underground system of the Anglo-Argentine Tramways Co. carried increased traffic, there was a decline in the receipts, generally, owing to the expiry of the term of the increased fares, and the refusal of the Municipality to renew it. The report states that the Anglo-Argentine and Lacroze companies had secured the support of the municipal administration to a revised system of fares which would restore the financial position and enable the former to proceed with the construction of a badly-needed underground tramway system connecting railway termini, but that the Municipal Council had so far failed to ratify the agreement. There have, of course, been further developments in this matter since the report was written.

The transportation system of Buenos Aires has been rendered difficult to operate by large numbers of privately-owned motor 'buses.

The Municipality of Rosario approved during the year the specification for tenders to be invited to provide that town with a new electric tramway system comprising 396 km. of track.

Radio-Telegraphy and Telephony and Cables.

The high-power station at Monte Grande, built by the Telefunken Co. and operated by Transradio Internacional, a company in which Marconi's, Telefunken, the Radio Corporation and the French T.S.F. are equally interested, commenced service in January, 1924, with services to New York, Paris, and Berlin. By the terms of its concession, the radio tariffs were fixed at two-thirds of the cable tariffs existing in October, 1922. This restriction has now been abolished and tariffs were raised in August, 1924, to an average of 20 to 22 per cent. below present cable rates. As the station was still unfinished only deferred traffic was handled. With one transmitter serving in turn three circuits, there are obvious disadvantages in attempting to handle ordinary and urgent messages in competition with the cables, but the company appears to have attracted the greater part of the deferred traffic, and is working almost up to its technical capacity. Duplication of the transmitter is now in hand, and great hopes are based on the short-wave system. Senator Marconi carried out tests between Poldhu and Buenos Aires in July last which were reported as entirely successful. The English service will be commenced as soon as the Marconi Co. obtains a licence, and this will place British traders on an equal footing as regards cost of messages with their competitors.

The market for radio-telephone apparatus has suffered a serious slump owing to overloading of the market through over-estimation of the material that would be taken. The Argentine Company, "Radio Sub-America" formed by the British Marconi, American Radio Corporation, French T.S.F., and German Telefunken groups has found its policy of sales for joint account unworkable, and the four companies have recovered their independent liberty of sales. The liquidation of the large stock held has demoralised the market. When Radio Sud America abandoned broadcasting, it was replaced by an association composed of radio dealers which supplies

* Stationery Office. Price 2s. net.

† The gold peso equals 47.62d. at par. Average: 1922, 44¼d.; 1923, 41¼d.; 1924 (6 months), 41¼d.

an efficient service, and several other broadcasting organisations are operating, but the standard is not as high as in England, owing to the lack of funds and public support. The projected radiotelephone service in Patagonia did not materialise as the Government was unwilling to grant a concession.

During 1924 the Italian Submarine Cable Co. made substantial progress with its plans for laying an Italian-South American cable *via* Malaga to Brazil, Uruguay, and Buenos Aires. The company obtained its concession for the section from Montevideo to Buenos Aires in June, 1924, undertaking to present definite plans and specifications within 10 months and to open the cable to public service within two years from the date of approval of the plans. A large part of the capital of 200 million lire was subscribed in Argentina.

Port Works.

Of the new port extension works under construction at Buenos Aires for the Argentine Government the fourth dock was completed in 1923, with the access channel from the new ante-port, but the dock has not yet been opened to public service by the Government, as Congress has not yet voted the necessary money for the construction of the deposits, grain elevators, and general equipment of the dock. In anticipation of this vote the Government may invite tenders shortly for the loading and discharging equipment, comprising electric plant, cranes, winches, lifts, &c., at an estimated cost of some $2,300,000 paper. The second and third docks have now also been completed, with the surrounding quay areas, but equipment is delayed pending appropriation of funds. Authority is expected to be given shortly for the commencement of the first section of the commercial port of Bahia Blanca, at a cost of $920,000 out of a total estimated cost of works at the port of $5,000,000. Other port works proceeding or contemplated are those of Mar del Plata, Santa Fé, Quequen, Comodoro Rivadavia, Deseado, Diamante, and the provision of floating wharves at various small river ports of the rivers Parana, Uruguay and Paraguay.

General.

The Merchandise Marks Law which was to have come into force in November last may involve exporters to Argentina in uncertainty and difficulties, owing to the nature of the markings required. Commercial and industrial interests have made representations to Congress on the subject, and a project to modify or postpone the law has been reported favourably through the committee stage.

The remaining war-time prohibitions against the export of certain articles, principally metals, were removed in May, 1924, with the exception of those on rails and tinplate cuttings.

The Customs Tariff Bill now under consideration does not propose a fundamental revision of the tariff system, but would suppress the surtaxes and the 25 per cent. addition to the specific duties imposed in 1923. The valuations of a limited number of articles are modified, in some cases downwards, but in many important items in an upward direction.

Labour conditions were good during the period covered by the report, there being practically no unemployment. Wages remained stationary, and the cost of living showed a slight decrease.

Canadian Electrical Imports and Exports.

The following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1924, are taken from the recently-issued trade statistics. Figures for the year 1922-23 are given for purposes of comparison, and notes of any increases or decreases have been added:—

IMPORTS.

	1922-23 $	1923-24 $	Inc. or dec. $
Copper wire, plain, tinned, or plated—			
Total	31,000	67,000	+ 36,000
From United Kingdom	2,500	2,000	− 500
„ United States	28,000	65,000	+ 37,000
Copper wire, covered, including cable—			
Total	277,000	347,000	+ 70,000
From United Kingdom	21,000	77,000	+ 56,000
„ United States	253,000	264,000	+ 11,000
Electric batteries, primary—			
Total (mainly from U.S.A.)	38,000	40,000	+ 2,000
Electric batteries, storage—			
Total	687,000	765,000	+ 78,000
From United Kingdom	134,000	221,000	+ 87,000
„ United States	553,000	544,000	− 9,000
Electric fans—			
Total	128,000	70,000	− 58,000
From United Kingdom	2,000	1,000	− 1,000
„ United States	120,000	67,000	− 53,000
Electric fuses, fuse plugs, and cut-outs—			
Total	156,000	200,000	+ 44,000
From United Kingdom	1,000	—	− 1,000
„ United States	153,000	199,000	+ 46,000
Lightning arresters, choke coils, &c.—			
Total (mainly from U.S.A.)	139,000	140,000	+ 1,000
Rheostats, controllers, &c.—			
Total (mainly from U.S.A.)	228,000	426,000	+ 198,000
Sockets, outlets, and receptacles—			
Total	131,000	147,000	+ 16,000
From United States	123,000	139,000	+ 16,000
„ Japan	8,000	8,000	—
Spark plugs, magnetos, and other ignition apparatus—			
Total	390,000	568,000	+ 178,000
From United States	386,000	562,000	+ 176,000
„ United Kingdom	4,000	6,000	+ 2,000
Electric cooking and heating apparatus—			
Total	112,000	159,000	+ 47,000
From United Kingdom	1,000	4,000	+ 3,000
„ United States	110,000	154,000	+ 44,000
Dynamos and generators—			
Total	1,317,000	1,214,000	− 103,000
From United Kingdom	21,000	149,000	+ 128,000
„ United States	1,272,000	1,064,000	− 208,000
Electric light fixtures—			
Total	448,000	546,000	+ 98,000
From United Kingdom	9,000	6,000	− 3,000
„ United States	415,000	520,000	+ 105,000
Electric meters—			
Total	227,000	270,000	+ 43,000
From United Kingdom	53,000	49,000	− 4,000
„ United States	174,000	221,000	+ 47,000
Arc lamps—			
Total (mainly from U.S.A.)	33,000	39,000	+ 6,000
Incandescent lamps—			
Total	758,000	689,000	− 69,000
From United Kingdom	41,000	22,000	− 19,000
„ United States	131,000	107,000	− 24,000
„ Japan	93,000	77,000	− 16,000
„ Holland	306,000	331,000	+ 25,000
„ Belgium	99,000	69,000	− 30,000
Electric motors—			
Total	1,582,000	1,929,000	+ 347,000
From United Kingdom	94,000	108,000	+ 14,000
„ United States	1,480,000	1,811,000	+ 331,000
Self-contained lighting sets—			
Total (mainly from U.S.A.)	76,000	67,000	− 9,000
Telegraph instruments—			
Total	979,000	1,044,000	+ 65,000
From United Kingdom	90,000	108,000	+ 18,000
„ United States	785,000	932,000	+ 147,000
Telephone instruments—			
Total	797,000	483,000	− 314,000
From United Kingdom	347,000	60,000	− 287,000
„ United States	450,000	422,000	− 28,000
Switches, switchboards, circuit breakers, and parts—			
Total	734,000	1,059,000	+ 325,000
From United Kingdom	19,000	43,000	+ 24,000
„ United States	711,000	999,000	+ 288,000
Transformers—			
Total	152,000	382,000	+ 230,000
From United Kingdom	2,000	6,000	+ 4,000
„ United States	150,000	293,000	+ 143,000
Electrical apparatus, n.o.e.—			
Total	2,997,000	3,736,000	+ 739,000
From United Kingdom	143,000	139,000	− 4,000
„ United States	2,847,000	3,571,000	+ 724,000
Steam engines—			
Total	318,000	260,000	− 58,000
From United States	268,000	181,000	− 192,000
„ United Kingdom	65,000	110,000	+ 45,000

EXPORTS.

Batteries, telegraph and telephone apparatus—			
Total	273,000	450,000	+ 177,000
To United Kingdom	11,000	138,000	+ 122,000
„ United States	8,000	46,000	+ 38,000
„ Newfoundland	10,000	17,000	+ 7,000
„ Australia	52,000	53,000	+ 1,000
„ New Zealand	27,000	65,000	+ 28,000

	1922-23 $	1923-24 $	Inc. or dec. $
Dynamos, generators, and motors—			
Total	43,000	20,000	– 23,000
To United Kingdom	1,000	1,000	—
,, United States	26,000	10,000	– 16,000
,, New Zealand	3,000	1,000	– 2,000
Electric cooking and heating devices—			
Total	42,000	101,000	+ 59,000
To United Kingdom	1,000	2,000	+ 1,000
,, New Zealand	16,000	56,000	+ 40,000
,, Australia	20,000	37,000	+ 17,000
Spark plugs, magnetos, and other ignition apparatus—			
Total	216,000	245,000	+ 29,000
To United Kingdom	116,000	108,000	– 8,000
,, Australia	36,000	67,000	+ 31,000
,, New Zealand	13,000	23,000	+ 10,000
,, British South Africa ...	26,000	16,000	– 10,000
Electrical apparatus, n.o.e.—			
Total	625,000	1,067,000	+ 442,000
To United Kingdom	336,000	698,000	+ 362,000
,, Australia	29,000	38,000	+ 9,000
,, New Zealand	63,000	72,000	+ 9,000
,, Newfoundland	8,000	19,000	+ 11,000
,, United States	38,000	42,000	+ 4,000
,, France	—	10,000	+ 10,000
,, Japan	71,000	93,000	+ 22,000
Copper wire and cable, insulated—			
Total	291,000	444,000	+ 153,000
To United Kingdom	12,000	—	– 12,000
,, United States	41,000	2,000	– 39,000
,, Brazil	31,000	164,000	+ 133,000
,, British South Africa ...	105,000	—	– 105,000
,, Newfoundland	8,000	21,000	+ 13,000
,, New Zealand	58,000	49,000	– 9,000
,, Cuba	2,000	123,000	+ 121,000

The total value of all electrical apparatus, including lamps and fixtures, imported into the Dominion rose from $12,110,000 in the fiscal year ended March, 1923, to $13,977,000 in the following 12 months, whilst that of similar apparatus exported fell from $1,999,000 in 1922-23 to $1,884,000 in 1923-24.

Ferro-Concrete Cooling Towers.—Recent developments in ferro-concrete cooling towers were described by Mr. H. A. Rickwood, A.M.I.E.E., &c., in a paper recently read before the Society of Engineers. The author submitted that the life of the shell of timber towers was comparatively short and that great care and frequent overhaul were necessary if they were to last any time. Dealing with the application of reinforced concrete, Prof. F. K. van Iterson, director of the Dutch State Mines at Heerlen, and Mr. G. Kuypers, chief building surveyor of the city of Amsterdam, had found that the best results could only be obtained economically when using much larger towers than had been used so far and collecting tanks of great capacity. A long rectangular shape did not permit the water to be discharged in a thoroughly uniform manner through longitudinal troughs, secondary gutters, &c., and the most satisfactory arrangement would be to provide large circular towers about 100 ft. in diameter, and the inlet piping should deliver in the centre of the tower, the water being carried towards the outer parts by means of radiating troughs feeding in their turn gutters arranged in parallel concentric lines, each triangular sector being thereby fed in exactly the same way.

It was desirable that the internal cooling stack should be entirely unconnected with the shell, and also that the interior of the shell should be entirely free from transverse stays which would interfere with the regularity of the air draught. The best solution would be to adopt a ferro-concrete shell and give to the structure a hyperbolic shape.

The inlet water pipe is brought to the centre of the tower at a level coinciding practically with that of the water in the pond. It then bends up and discharges through an inverted conical shape funnel (thus reducing the speed of the water at the inlet). At the top of the stack radiating troughs carry the water towards the shell and feed subsidiary gutters. Along the length of the latter spray nozzles are distributed which discharge the water on earthenware saucers so that the splashing water becomes a fine spray, the drops falling upon wooden laths down into the pond. Owing to the slope of the laths the drops of water are guided towards the outside of the shell.

In daytime, it was pointed out, the temperature of the cooled water is generally lower than shown by the average curve, whereas during the night it is generally higher; although this state of affairs is not detrimental to the work of a power station, it proves that if the plant is tested only in the daytime (and especially, as is often the case, during the morning) the results will show the plant in too good a light, a fact too often ignored when comparing cooling plant.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found at the end of the specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

13,034. "Thermionic valve devices." G. C. Beddington. March 1st, 1924. (225,584.)

18,887. "Radio telephony." W. D. House. July 23rd, 1923. (225,[illegible])

19,387. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). July 28th, 1923. (Cognate application, 19,388/23.) (225,591.)

19,493. "Radio telegraphy and telephony." H. J. Round, T. L. Eckersley, and G. M. Wright. July 30th, 1923. (225,592.)

20,030. "Electric cable joint boxes, switch boxes, troughs, and the like." J. C. Lee. December 11th, 1923. (225,596.)

20,247. "Means of secret wireless intercommunication." E. H. Wright and F. Hodgson. August 9th, 1923. (225,597.)

21,583. "Electric switches." W. Preston. August 27th, 1923. (225,[illegible])

21,743. "Systems of measuring physical values by electric current impulses." E. Roucka. September 1st, 1922. (203,329.)

21,802. "Means of reducing echo effects in telephone lines." C. Robinson and R. M. Chamney. August 29th, 1923. (225,603.)

21,835. "Portable loud-speaking telephonic apparatus." E. A. Graham. August 29th, 1923. (225,604.)

21,899. "Systems for varying electrical frequencies." M. Compare and T. C. Gibson. August 30th, 1923. (225,605.)

22,024. "Resistors for electric heating." Morgan Crucible Co., Ltd., and C. W. Speirs. August 31st, 1923. (225,608.)

22,151. "Double-pole electrical connectors." C. E. Foster. September 3rd, 1923. (225,612.)

22,225. "Relays for electric protective systems." September 4th, 1923. A. Reyrolle & Co., Ltd., and W. Lulois. (225,616.)

22,242. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. February 2nd, 1923. (Addition to 196,245.) (210,733.)

22,306. "Electric switches." J. A. Crabtree. September 5th, 1923. (225,619.)

22,334. "Screw-driving attachments or appliances for use with pneumatic, electric, or other machine tools." Consolidated Pneumatic Tool Co., Ltd., and A. J. Kennell. September 5th, 1923. (225,620.)

22,376. "Incandescent electric lamps." C. M. Page. September 5th, 1923. (225,623.)

22,419. "Poles for supporting overhead electric conductors and the like." British Electrical and Allied Industries Research Association and E. B. Wedmore. September 6th, 1923. (225,625.)

22,449. "Electrical heating of buildings." J. L. Musgrave and Grierson, Ltd. September 6th, 1923. (225,627.)

22,488. "Automatic telephone systems." Relay Automatic Telephone Co., Ltd., T. M. Inman and R. G. Vanneck. September 6th, 1923. (225,630.)

22,633. "Multiplex electrical signalling." A. Van T. Day. September 11th, 1922. (203,711.)

22,795. "Coil-holders for wireless telegraphy." J. R. Spink and J. S. Langley. September 11th, 1923. (225,634.)

22,962. "Wireless electric signalling systems." Compagnie pour la Fabrication des Compteurs et Material d'Usines à Gaz. October 18th, 1923. (205,472.)

23,998. "Electric switches." J. B. Tucker. September 26th, 1923. (225,652.)

24,186. "Electrical heating of buildings and the like." J. L. Musgrave and Grierson, Ltd. September 28th, 1923. (225,654.)

25,369. "Audible warning signals." J. F. Monnot. October 11th, 1923. (225,665.)

25,373. "Electrical switchgear." D. R. Davies, E. M. Johnson, and Metropolitan-Vickers Electrical Co., Ltd. October 11th, 1923. (225,666.)

28,497. "Thermionic valves or electron-discharge tubes, particularly for wireless signalling." L. A. Levy. November 12th, 1923. (225,694.)

29,702. "Selective receiving circuits for signal transmission systems." Siemens & Halske Akt. Ges. November 25th, 1922. (207,553.)

30,482. "Telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. December 4th, 1923. (225,703.)

30,499. "Selective and anti-parasitic receiving systems for low-frequency constant period, damped or sustained electric currents, and electromagnetic waves." Marrec, Ltd., and Y. Marrec. December 4th, 1923. (225,704.)

32,116. "Wireless receivers." Soc. Française Radio-Electrique. December 21st, 1922. (Addition to 190,505.) (206,730.)

32,304. "Telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. December 27th, 1923. (225,717.)

1924.

233. "Electric storage batteries." J. Stone & Co., Ltd., and A. H. Mingley. January 3rd, 1924. (225,719.)

3,275. "Electric motor starters." J. A. Hirst and Brook, Hirst & Co., Ltd. (in liquidation). September 8th, 1923. (Divided application on 213,[illegible].) (225,739.)

4,191. "Electric motors." Dr. L. Torda. April 17th, 1923. (214,587.)

5,148. "Electromagnetic clocks." Etablissements L. Hatot. September 27th, 1923. (222,432.)

5,680. "Spring contact devices for electrical switch apparatus." Akt. Ges. Brown, Boveri et Cie. March 5th, 1923. (212,562.)

8,041. "Means of coating silicious or vitreous articles, such as electric light bulbs." A. S. Cachemaille (Westinghouse Lamp Co.). March 28th, 1924. (225,763.)

10,382. "Electric heating elements for boiling and grilling apparatus." Falkirk Iron Co., Ltd., and A. R. Wood. April 28th, 1924. (225,789.)

10,790. "Circuit arrangements employing vacuum tubes." British Thomson-Houston Co., Ltd. May 4th, 1923. (Addition to 206,837.) (215,373.)

15,460. "Electric cables." S. Silbermann. June 30th, 1923. (218,312.)

15,880. "Collectors for overhead electric lines." T. Brooks and Wood-Gilbert Rail Remodelling Co., Ltd. July 2nd, 1924. (225,787.)

16,974. "Devices for heating the internal mercury-vapour high-vacuum pump of a rectifier." Akt. Ges. Brown, Boveri et Cie. July 30th, 1923. (219,966.)

18,345. "Production of magnetic steels with a high content of silicon." P. Thaud and Soc. Electro-Métallurgique de Montricher. September 25th, 1923. (220,083.)